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CONTENTS

BIOGEOGRAPHICAL RESEARCH IN HIGH SIMIEN (NORTHERN ETHIOPIA), 1952–53

By Hugh Scott, Sc.D., F.R.S., F.L.S.

(Read 4 March, 1954; printed in abstract 1956, *Proc. Linn. Soc. Lond.*, **166**, 12–13)

(With Plates 1–17, 2 folding maps and 6 text-figures)

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Contents

Page

Introduction : Origin and Purpose of the Journey 3

A. General Considerations

Part 1. Topographical and Geological :—

Derivation of the altitudes and sources of the maps in this paper 5
Situation, great height and relative isolation 5
Topography of Simien and Tsellemti 6
Geological formation 7
Relation of Simien to the Rift-Valley System ; Lake Tana not a rift-lake 10
Glaciation in Simien and other parts of Ethiopia 11
Effects of topography and geological formation on the fauna and flora 14
Effects of former volcanic eruptions and glaciation 14

Part 2. Biogeographical :—

Introductory remarks 15
Examples of affinities among mammals and birds 15
Review of material collected :—
Mollusca (with note on melanism at high altitudes) 16
Coleoptera (with notes on flightlessness, restriction to particular massifs, 'regressive evolution' in montane Coleoptera, etc.) 17
Lepidoptera Rhopalocera 23
Hymenoptera Aculeata 24
Diptera (with notes on congregating and on melanism) 24
Orthoptera 26
Diplura 28
Thysanoptera 28
Arachnida, Opiliones 28
Crustacea, Isopoda 28
Biogeographical relationships of the flora : (*a*) recent opinions ; (*b*) [zones recognized by the Ethiopians] ; personal impressions (belts or zones of vegetation ; montane plants of northern affinities, etc.) 29
Biogeographical relationships of fauna and flora compared 33
Lack of certain components in the montane fauna 34
[Effect of glaciation on the insect-fauna of the Hawaiian Islands ; a distant comparison] 35

Part 3. Previous Exploration :—

Remarks on general exploration ; sportsmen and zoologists ; entomological exploration ; Raffray's early delimitation of altitude-zones ; early collectors of Mollusca ; geological and botanical exploration 36

Summary of Parts 1–3 39

B. Weather Notes

Page

Asmara: temperature, rainfall 42

The High Mountains: climatic differences between Simien and Gughé; weather encountered in 1952; temperature; frost; relative frequency of hail and snow in Simien 43

C. Narrative

(The principal divisions are indicated in capitals, but only the more important contents of each are listed here.)

Preliminary Information: routes and distances; populations and languages, etc. p. 46.

Asmara: grain and wood markets, camel transport, p. 49; butterflies and garden-flowers in October, p. 49; behaviour of honey-bees, p. 49; vegetation near top of escarpment, spread of prickly pear (*Opuntia*), p. 50.

South to Debārec: valley of the Mareb, p. 50; police escort from Enda Sellassié, p. 51; agricultural methods, three main agricultural economies, p. 51; folk-lore concerning animals, p. 52; valley of the Tacazzé, forests, etc., p. 52; strange scenery, p. 53; Zarīma valley (forests) and Wolkefit Pass (changes in vegetation), p. 55; old name Lemalemo (Lamalmon) still in use, p. 56; Debārec (present district-centre of Simien and former centres; market; entomologizing, etc.), p. 56; local movements of birds, p. 57.

The Caravan Journey in High Simien:—
Composition of caravan, route, etc., p. 58.

Debārec to Khabau: mountain flowers, p. 58.

The Ambaras Ridge and Arghine: rotation of crops, p. 59; a church festival near the chief's residence, p. 59; Arghine, frosts, cries of shepherd-boys, fewness of wild mammals, p. 60.

The Chennec Pass, Mt. Buahit and Lori: vegetation of highest altitudes; thunder and hailstorms, p. 61.

Across the Mai Shāha Valley to Ras Degien: a small rodent in warrens; Atgheba Ghiyorghis; abundance of choughs, p. 63; crossing the Mai Shāha valley, p. 64; ascent to the Pass of Degien, p. 64.

The Mai Shāha Valley and ascent again to the western plateau: terraced fields, etc.; epidemic diseases, p. 65; insects from flowering trees and shrubs, p. 66; ascent to the western plateau, p. 66.

The southern edge of the plateau, westward to Derasghié; remains of juniper forest, p. 67; Derasghié, church designed by G. W. Schimper, p. 67; a cave containing a church, p. 68.

Return to Debārec across the Mai Beleghès: addition of stones to wayside heaps by travellers; a spider in communities; phonolites; ascent to Ambaras ridge and return to Debārec, 69.

After the Caravan Journey: Debārec to Gondar and Lake Tana, p. 70.

D. Lobelia rhynchopetalum, its associated animals, etc.

Description; vernacular names; uses; folk-lore; list of animals associated with the plant; summary of list and discussion; pollination 71

Appendix 1: Sources of Maps and Altitudes used; Notes on Lake Tana.. 75

Appendix 2: Amount and Situation of Collections made in 1952–53 78

Appendix 3: Transliteration and the Meaning of certain Place-names.... 78

Personal Acknowledgments 80

Bibliography:—
(1) Published results of the journeys to the Gughé Highlands (1948–49) and to Simien, with supplement to results of the 1926–27 Expedition 81
(2) References to works cited in the present paper 83

Index of Genera and Species of Animals and Plants mentioned (with authors' names, not usually given in the text) 86

List of Maps and Text-figures 89

Explanation of Plates 1–17 89

Postcript 90

Introduction: Origin and Purpose of the Journey

> Disinterested intellectual curiosity is the life-blood of real civilization.—*G. M. Trevelyan, English Social History*, 1942, Introduction, p. viii.

During the six months from 8 September 1952 to 8 March 1953, when I left and returned to England by sea, I was engaged in a journey to Eritrea and northern Ethiopia. Its purpose, biogeographical research in the high Simien district, could not have been achieved without financial assistance from the Royal Society, the Trustees of the Percy Sladen Memorial Fund, and the Leverhulme Trustees' Advisory Committee (besides such private contribution as I could make). Thanks are also due to the Trustees of the Botanical Research Fund for contributing to the cost of the botanical illustrations. I would therefore here express my indebtedness for their generosity to the bodies named, leaving to a later section (p. 80) acknowledgments of help received from officials and private persons.

My principal aim was to collect insects and, as far as possible, other invertebrate animals, in these northern highlands where, though mammals and birds had attracted several previous expeditions, the insect fauna had never been systematically investigated; and particularly to throw light on the relationships between the forms inhabiting high Simien and those of the high massifs in central and southern Ethiopia which had been the goal of my two earlier journeys in the country.

Moreover, though Simien was explored botanically in the 19th century and again as recently as 1937, the plants collected in 1952 are considered valuable as new material.[1]

The motive of this third journey in high Ethiopia was in principle the same as that underlying the second, or 'Journey to the Gughé Highlands (southern Ethiopia), 1948–49', which in turn arose mainly from a desire to follow up certain results of my first expedition. I had then, in 1926–27, discovered an association of high-mountain insects inhabiting the mountains rising from the general level of the high plateaux (i.e. from about 7000 to above 8000 feet) to altitudes ranging from 10,000 to more than 13,000 feet. Some of these insects are specially associated with afro-alpine plants, and some belong to genera represented by distinct species on the several high massifs of central, eastern and north-eastern Africa.

These investigations, as previously remarked (1952, pp. 88–89), should be considered as 'part of a series of biogeographical explorations aimed at discerning the pattern of the distribution of certain groups of organisms over all the high mountains of eastern Africa.' In my account (1952) of the Gughé Highlands journey I listed a number of relevant natural-history explorations during the last half-century, beginning with Sjöstedt's Expedition to Mts. Kilimanjaro and Meru in 1905–06.[2]

Beyond a passing allusion (1952, p. 90), I purposely omitted Simien from the list of faunistic explorations of which mine form part, because I had not then visited these northern highlands. But I had long considered the project, and an expedition (in which I should have been accompanied by the late A. H. G. Alston, as botanist), fully arranged early in 1935, was only cancelled at the last

[1] An illustrated narrative of my journey, mainly from the botanical standpoint, appeared in 1955, *Webbia*, **11**, pp. 425–450, pls. 3–12.

[2] The account of the Gughé Highlands journey also contained (1952, pp. 178–181) a bibliography of the results of the 'Entomological expedition to Abyssinia, 1926–27'. References are given below to some taxonomic papers which should have been included, but of which I did not know till later. Works by specialists on the results of the two later journeys, 1948–49 and 1952–53, which have appeared to date are also listed.

moment owing to the imminence of war between Italy and Ethiopia. Again, as recently as 1949 I asked in Addis Ababa about the possibility of visiting Simien, but there still seemed to be no hope. Late in 1951, however, the opportunity unexpectedly arose. So in 1952 I at length reached my goal, after waiting 17 years, and alone.

Considering the Ethiopian highlands as a whole, though their insects have been studied to a point, much remains to be done. But while many expeditions have visited the more spectacular African highlands, the Ruwenzori range, Mt. Kenya, Mt. Kilimanjaro, etc., Ethiopia has been comparatively neglected hitherto, partly owing to the difficulty of travel there. Scientifically, however, much is lost if this vast territory be ignored. The detached blocks of highlands in Ethiopia are not merely poorer editions of the great massifs in eastern Africa. Though the highest mountains of Ethiopia reach lesser altitudes, the average height of the plateaux is greater. In scenery and in other ways the country presents very special features. Its more northern situation renders it likely that additional links with northern fauna await discovery. Perhaps botanists, more than entomologists, have recognized the peculiar interest of Ethiopia.

Besides the special aims outlined above, my broader purpose has been to consider and co-ordinate the principal factors and processes involved in the formation of the relatively isolated block of the Simien highlands, and how these processes may have affected the composition of the present fauna and flora. Though the subject cannot be compassed in all its bearings, causes may to some extent be related with their effects.

Some words in the Presidential Address delivered by Lord Adrian to the Royal Society in November 1954 (after I had begun this paper) seem pertinent to the method here followed. Speaking of the now vast range of natural science, in which, a century earlier, many scientists knew at least the general content of every branch, he said that while 'we still have a few who can survey the whole field', it becomes daily more difficult to find scientists of sufficiently wide interests to assist the advance of science ' by helping the specialists to understand one another ' (1955, *Proc. roy. Soc.* A, **227**, 279–287, especially pp. 283–284).

While far from claiming to ' survey the whole field ', yet, as biogeographical studies overlap several departments of scientific knowledge, I have tried to treat the massif of high Simien from several angles, as an entity, almost as though it were an island.

To this end, the first portion (A, General Considerations) of the present study consists of :—Part 1, Topographical and Geological, in which the topography and geology of Simien and its relation to the Rift-Valley System are outlined, also agencies to which the region has been subjected, especially volcanic activity and glaciation, and their effects on animals and plants ; Part 2, Biogeographical, in which the characteristic features of the existing fauna (mainly insects) are summarized, its relationships are briefly discussed and compared with those of the flora ; Part 3 is a short account of Previous Exploration, principally zoological and botanical ; a Summary of Parts 1–3 is added.

The second portion (B, Weather Notes) contains some data regarding the climate of northern Ethiopia, and remarks on the weather during my journey.

The third, C, Narrative, is a description of the journey ; while D is devoted to the giant *Lobelia rhynchopetalum* and animals (mostly insects) associated with this plant. Though *ecology* is not treated in a separate portion, the habitats of particular species are mentioned in A, Part 2 (Biogeographical), in C (Narrative), and in D (under the giant lobelia).

The subjects of the Appendices are indicated by their titles.

A. GENERAL CONSIDERATIONS

Part 1: Topographical and Geological

Derivation of the altitudes and sources of the maps in this paper. Details are given in Appendix 1 (pp. 75). I need here only warn readers that Ethiopia, unlike better known parts of Africa, is still very incompletely surveyed. Consequently the folding map of my caravan trek (opposite p. 58), though based on the most recent and reliable published maps, is only approximately correct.

Most of the smaller places marked in my map will not be found in any atlas, many of them not even on the recent sheets of the International Map, while some published place-names are wrongly spelt by any system of transliteration.[3] Notwithstanding these difficulties, I have striven to attain the highest possible degree of accuracy in recording the situations and altitudes of the places where I collected specimens, both in this paper and on the printed labels attached to the specimens.

As to *altitude*, the data in northern Ethiopia (including Simien) are more reliable than those in the centre and south. In the north many estimates of height do not depend solely on observations by aneroid, but were fixed long ago by trigonometric methods, starting from sea-level. Recent revisions of some of these heights have revealed slight discrepancies, too small to be of biological importance.

In short, I am satisfied that the maps and altitudes here given are near enough to the truth for biogeographical purposes. But some readers may be interested in the summary (given on p. 76) of successive efforts to ascertain the true height of Ethiopia's highest mountains.

Situation, great height, and relative isolation: the peculiar interest of Simien, biogeographically and otherwise, lies in the district being situated so far north, and in its peaks being higher than any others in Ethiopia—as well as in their extraordinary formation (p. 53).

As I have stressed above (and 1952, p. 92) the average height of much of the Ethiopian plateaux is exceptionally great, but the altitudes of the isolated massifs rising above the plateaux are less than those of the high mountains of eastern and central Africa. No peak in Ethiopia rivals Kilimanjaro (recently estimated at 19,500 feet), Mt. Kenya (over 17,000 feet), or the Ruwenzori range (nearly 16,800 feet), to name the three highest in Africa.

In Ethiopia, only the Degien massif in Simien exceeds 15,000 feet. Among the long-accepted figures shown on the maps in this paper, the highest summit, Ras Degien[4] itself, was taken as 15,154 feet; and other crests of the massif exceeded 15,000 by lesser amounts; but if a recent correction (see p. 76) be accepted, probably only Ras Degien proper is above 15,000 feet. Apart from the Degien massif, however, Mt. Buahit and probably at least two other peaks in northern Simien exceed 14,000 feet. (Comparing with the Alps, the highest point is some hundreds of feet less than Mont Blanc.)

According to the most recent maps, only one other point in Ethiopia exceeds 14,000 feet, namely Batu, marked 14,131 feet (4307 m.) in the south-east

[3] On the sketch-maps in the narratives of travellers the same name may be transliterated differently, according to the system used (if any) and, still more, the nationality of the traveller; e.g. British, French, German and Italian writers transliterate the same name differently in many cases (see Scott, 1952, Appendix C, pp. 176–178).

[4] The name is often mis-spelt 'Ras Dashan', though sounded nearly like the English word 'dudgeon'; this is explained under 'transliteration' in Appendix 3 (p. 78).

Pichi-Sermolli (following the early explorer d'Abbadie) used distinct names for the several summits of the massif; emphasizing (1940, p. 10) that the entire group is called Degien, the highest summit Ras Degien, and slightly lower crests Ancua, Ualta, etc. As stated in my narrative (p. 00) I did not hear these names used; I only heard the massif as a whole called 'Degien' without the title 'Ras' prefixed.

(situated about 39° 45′ E. and 6° 55′ N., a little south-west of Goba,[5] and about 93 miles east-north-east of Dallé or Irgalam). Several mountains, however, reach well over 13,000. Others exceed 12,000 or attain altitudes which, though less, are still above 10,000 feet (see Fig. 5, p. 47).

Thus the highest points in Simien exceed almost all other mountains in Ethiopia by some hundreds of feet, while much of the undulating plateau is exceptionally high.

The folding relief map (opposite p. 6) also indicates the degree of isolation of the Simien peaks. The principal high points visited on my earlier journeys, i.e. in the Gughé Highlands, Mt. Chillālo and Mt. Zuquāla, are some of the farthest away. Thus the centres of Simien and of the Gughé Highlands are nearly 490 miles apart, almost directly north and south. The distance between Simien and Chillālo is about 365 miles, while Zuquāla, lying some 47 miles north-east of Chillālo, is a trifle nearer.[6]

But several mountains which I have not visited, are much closer to Simien. The nearest, Abūna Yosef (nearly 13,750 feet), is scarcely 95 miles to the south-east, though the high plateau between is cleft by the valley of the Tacazzé. Mt. Guna (13,880 ft.), the next closest, lies just over 100 miles south. The great massifs of the Choké mountains (highest point marked 13,350 feet)[7] lie roughly 180 miles away, a little west of south, within the loop of the Abbai (Blue Nile). On the opposite side of that river, Amba Farit (about 13,040 feet) is over 165 miles south-south-east of Simien. South-east of Amba Farit lies Abuià Miéda (about 13,120 feet), some 85 miles east of the Choké Mts., and roughly 200 miles from Simien. Other high massifs, at varying distances, are shown on Fig. 5.

Of the mountains named in the above paragraph, only Abūna Yosef and the adjacent summits of the district of Lasta have been the scene of serious entomological collecting, over 80 years ago, by Raffray (see p. 37). But as recently as about 1940, interesting insects were discovered by the late Marchese Saverio Patrizi on Mt. Termaber, shown on the relief map despite its attaining only somewhat above 10,000 feet.[8]

Considering the means of dispersal possessed by many organisms, some of the distances between the high massifs are not great, and their isolation is only relative. Yet Zuquāla, Chillālo, Damōta and the Gughé Highlands in the centre and south, and Simien in the far north, have furnished interesting cases of representative species of the same genus occurring on different massifs, and of forms so far only known from one massif. Should any specialist wish to fill in the biogeographical picture further, many high mountains in Ethiopia are still virgin ground.

Topography of Simien and Tsellemti. The district of Simien proper consists of a vast elevated block of volcanic rock, cut off abruptly on the north and west by stupendous precipices. Escarpments nearly as precipitous bound it on the

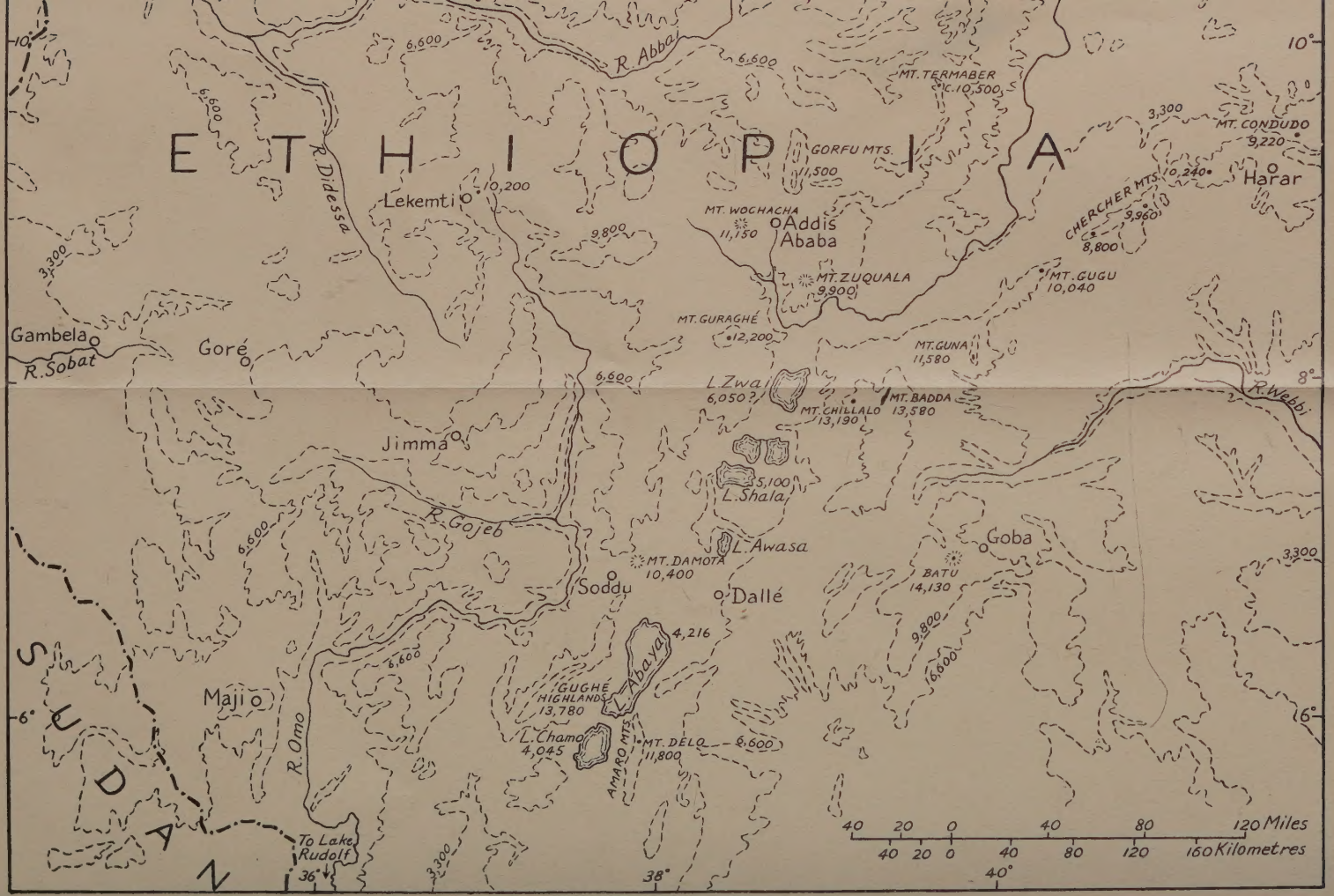
[5] This district was visited by the Finnish-Scandinavian Geographical Expedition to Ethiopia in 1953–54, under Professor H. Smeds, one of whose works (1955) is cited below.

[6] A line drawn between the centres of Simien and the Gughé Highlands lies about two points of the compass east of north and west of south ; while a line drawn from Simien to Chillālo is slightly more inclined from the meridian, but in the reverse direction. The heights which I took (1952, p. 90) for my previously visited summits were : Gughé Highlands, according to maps, *c.* 13,780 feet, possibly rather less ; Chillālo, *c.* 13,190 feet ; Zuquāla, *c.* 9900 feet.

[7] A recent visit to the Choké Mts. was that of the Cambridge University Botanical Expedition to Ethiopia, during the Rains of 1957. In their Interim Report (November 1957), the height of Mt. Talo, the highest point, is given as 13,460 feet.

[8] Mt. Termaber lies west of the road from Addis Ababa to Dessié, some 115 miles from the capital and a few miles from Debra Sina. The *Guida* (p. 405) gives 3250 m. (*c.* 10,660 feet), but the 1 : 1,000,000 map, sheet N.C. 37, marks a nearby point 3124 m. (*c.* 10, 250 feet), though not showing the name of the mountain.

PART OF
ETHIOPIA AND ERITREA
SHOWING GENERAL RELIEF
AND PRINCIPAL SUMMITS
Altitudes shown in feet
3,300ft. = 1,000 metres (approx)
6,600 " = 2,000 " "
9,800 " = 3,000 " "
13,100 " = 4,000 " "
36°
38°
40°
42°
16°
14°
12°
ERITREA
RED SEA
SUDAN
Massaua
Asmara
Kassala
R. Barca
R. Gash
R. Atbara
R. Setit
R. Mareb
MT. SEMAIATA
9,880
Adua
L. Assalè
-380
Below Sea Level
L. Afdera
(Giulietti)
-260
TAGLADÉ
RAS DEGIEN
SIMIEN
15,154
Gallabat
Metemma
Gondar
10,230
6,600
R. Taccaze
AMBA ALAGI
11,280
12,000
SARENGA
L. Ashangi
7,900
12,480
10,640
10,520
L. Tana
6,000
MT. ABUNA YOSEF
13,750
MT. ABBI
MIEDA
MT. GUNA
13,880
Roseires
Blue
3,300
6,600


ETHIOPIA
SUDAN
R. Abbaj
R. Didessa
R. Sobat
R. Gojeb
R. Omo
R. Webbi
Lekemti
Addis Ababa
Gambela
Goré
Jimma
Soddu
Dallé
Goba
Harar
Maji
To Lake Rudolf
MT. TERMABER c.10,500
MT. CONDUDO 9,220
GORFU MTS. 11,500
MT. WOCHACHA 11,150
MT. ZUQUALA 9,900
MT. GURAGHÉ 12,200
MT. GUGU 10,040
MT. GUNA 11,580
MT. BADDA 13,580
MT. CHILLALO 13,190
L. Zwai 6,050?
L. Shala 5,100
L. Awasa
MT. DAMOTA 10,400
BATU 14,130
L. Abaya 4,216
GUGHE HIGHLANDS 13,780
L. Chamo 4,045
AMARO MTS.
MT. DELO 11,800
CHERCHER MTS. 9,960
8,800
10,240
3,300
9,800
16,600
6,600
10,200
40 20 0 40 80 120 Miles
40 20 0 40 80 120 160 Kilometres

To face p. 6.

south and east. Only to the south-west does a broad range with gentler slopes, its northern part forming the high plateau of Woghera (Uoghera), connect high Simien with the smoother, more rounded contours of the mountains and valleys immediately north of Gondar.

Yet, as indicated on the folding map of the caravan journey, Simien proper is no single mountain range but is divided into secondary massifs and ridges. The whole has been aptly described (*Guida*,[9] p. 251) as a ' star-shaped plexus ' with ranges (*dorsali*) radiating from Degien.

The slanting-topped, table-mountain formation so frequent in Ethiopia is carried to extremes in Simien. Thus, from Debbivar, situated at 7200 feet at the foot of the northern precipice, the motor-road leads by sharp hairpin bends up the Wolkefit Pass to nearly 10,000 feet. But this point is not the top of a well-defined ridge, for the road slopes thence very gradually, only a hundred feet or so, down to the district-centre, Debārec ; while to descend far enough to reach an altitude corresponding to the starting point means a road journey of more than 60 miles south-west to Gondar. And when one travels the opposite way, gradually up the undulating tilted plateau to the edge of the northern escarpment, the earth seems there abruptly cut off, ending in space.

North of the huge northern escarpment of Simien proper, a wilderness of sharp-ridged lower ranges projects northwards to the Tacazzé. This maze of mountains, with *aiguilles* and other remarkable rock formations, constitutes the district of Tsellemti. The fantastic prospect, in which the peculiar features of Ethiopian landscape culminate, has over the centuries evoked graphic descriptions from numerous writers, some of them widely travelled. Brief impressions of the strange forms and contrasting colours of the mountains are attempted in my narrative (pp. 53–56).

Simien and Tsellemti, taken together, are (except on the south-west) almost shut in by deep canyon-like valleys. The Tacazzé, flowing from the south, turns west round the spurs of Tsellemti, enclosing the two districts on the east and north. On the south Simien is bounded by the Mai Beleghès, a major tributary flowing east to the Tacazzé ; while the north-western confines of Simien are almost shut in by northward-flowing affluents of the same river.

The Tacazzé, indeed, is so important topographically as to merit a few words. Believed to be the ASTABORAS of classical antiquity, it originates in streams rising south of Mt. Abūna Yosef, on the western slope of the ridge carrying the main highway from Addis Ababa northwards to Asmara. The course of the river from these sources to the confines of the Sudan is about 373 miles. But before reaching the frontier it takes the name SETIT, under which it continues till it flows into the ATBARA. The Setit, very low in the dry months, may even be reduced to a string of pools ;[10] the same applies to the lower courses of tributaries higher up the Tacazzé.

Geological formation. Why do the heights of Simien exceed all others in Ethiopia, and why are its precipices on so immense a scale even for that country ? To attempt an answer involves an outline of the geological structure, with some account of former volcanic activity in Ethiopia, and its dying manifestations at the present day ; also an outline of the extent of former glaciation in Ethiopia. What follows is drawn mainly from the writings of NILSSON (1940) and MINUCCI (1938), whose principal contributions, too little considered in British periodicals, are indicated below under ' Previous Exploration ' (p. 39) and included in the Bibliography.

[9] The Italian *Guida dell' Africa Orientale* (1938) is abbreviated throughout to *Guida*, as in my previous paper (1952).

[10] The great variety of vertebrate animals, aquatic and terrestrial, congregating in and near the Setit at its lowest, is noted in *Guida*, p. 228. The vegetation of the adjacent country is described by Pichi-Sermolli, ' Osservazioni sulla vegetazione dell' versante occidentale dell' altipiano etiopico ', 1940, *Nuovo Giorn. Botan. Ital.*, N.S. **47**, pp. 612–614.

According to Nilsson (1940, p. 57) the northern mountains of Simien, at any rate, are the remains of a gigantic volcano, with a crater over six miles in diameter, and with very gradually sloping, wide-spreading sides, built up by gently flowing lava (mainly basic). The lava has solidified in nearly horizontal beds, producing a ' stratoid ' formation, as in the great volcanoes still active in Hawaii. The present topography has come into being through the processes of erosion (including the glaciation considered below, pp. 11–14).

As shown in Fig. 2 (p. 9) this huge crater was in the north-east corner of Simien. Its northern and eastern parts have been mostly destroyed by erosion, leaving towering precipices from 1600 to over 3000 feet high. But three of the highest mountains existing at present, Abba Jared, Selki, and Beroc-Waha, are within the crater limits. On the other hand, the highest point of all, Degien, and also Buahit, are outside the crater, though they are remnants of the outer lava slopes.

Remains of other enormous volcanoes of this type have been traced in Ethiopia. For instance, Mounts Amba Farit and Kollo, south-east of Lake Tana, are the highest remaining parts of the walls of a crater about 25 miles across (Fig. 1). And in Arussi Province, south-east of Addis Ababa, ruins of another great volcano have been discerned in Mt. Badda, east of Mt. Chillālo (Nilsson, 1940, pp. 55–57). These giant volcanoes belong to the more ancient Trap Series, dating from early Tertiary, or possibly Cretaceous, times.[11] The much more recent volcanoes of the Aden Series (Pliocene and Pleistocene) are mentioned below.

The great height of Simien is partly due to the immense thickness of the ancient basaltic lava-beds of the Trap Series. These extend continuously to the highest existing summits, and amount to nearly 10,000 feet of ' stratoid ' layers, superficially resembling sedimentary strata (photographs, Plates 3 and 16). The whole mass is tilted downwards from east to west. The bottom of the volcanic trap lies between 3900 ond 4900 feet above sea-level along its eastern margin, but only between 2300 and 2600 feet above sea-level along its western edge. This huge block is based on antique metamorphic rocks, above which lie the Triassic (and possibly partly Liassic) Adigrat Sandstones, exposed in the valleys of the Tacazzé and its tributaries.

These basaltic layers consist of a lower and an upper series of Plateau Basalts or Trap (with local intercalations of sedimentary strata), traversed by intrusive eruptive formations, later than the basaltic layers, and more acid in composition. The intrusive formations project in moderate relief where erosion has acted less intensely, but form bold rock towers and spires in places where erosion of the surrounding rock has been more powerful. For instance, an irregularly pyramidal volcanic ' neck '[12] is a landmark on the motor-route, as it was formerly on the caravan track, leading south to Gondar, a little north of Dabāt.

Apart from these intrusions of harder rock, I saw in Simien proper no formation besides the layers of basalt, except that, in descending the west side of the deep Mai Shāha valley, some hundreds of feet above the ford (which lies at about 9300 feet) there was an abrupt transition from smooth basaltic blocks to a rough gritty rock, the nature of which I cannot verify.

[*Limestone.* Exposures which I could not visit occur in adjacent districts. Antalō, whence the limestones described by Blanford (1868) as Middle Jurassic,

[11] See G. Stefanini, 1932, section ' Geologia ' in article ' Etiopia', *Encicl. Ital. Sci.*, **14**, pp. 461–464 ; also account of geology in *Guida*, pp. 42–45.

[12] I heard no name for this peak. The *Guida* (p. 258) gives ' M. Uochen 3130 m.' (*c.* 10,000 feet). On the 1 : 2,000,000 map it is spelt ' Waqan '. Three of the members of Dr. Osgood's party, who visited Dabāt in 1927, asked the (then) Chief of Simien to call the mountain ' Strong's Peak ', after Walter Strong, who largely financed their expedition Baum, 1928, p. 232).

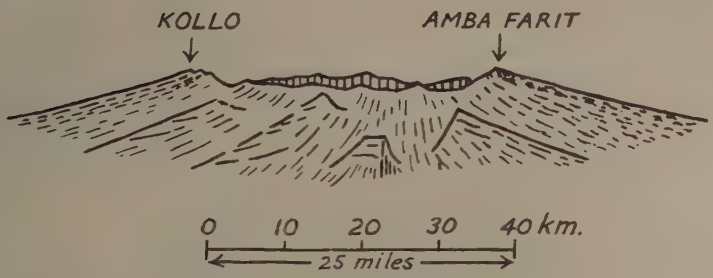


FIG. 1.—Remnants of a giant volcano, the highest parts of which are the mountains Amba Farit and Kollo about 25 miles apart (after Nilsson, 1940, fig. 37, p. 55). Amba Farit is shown on my first folding map over 100 miles south-east of Lake Tana.

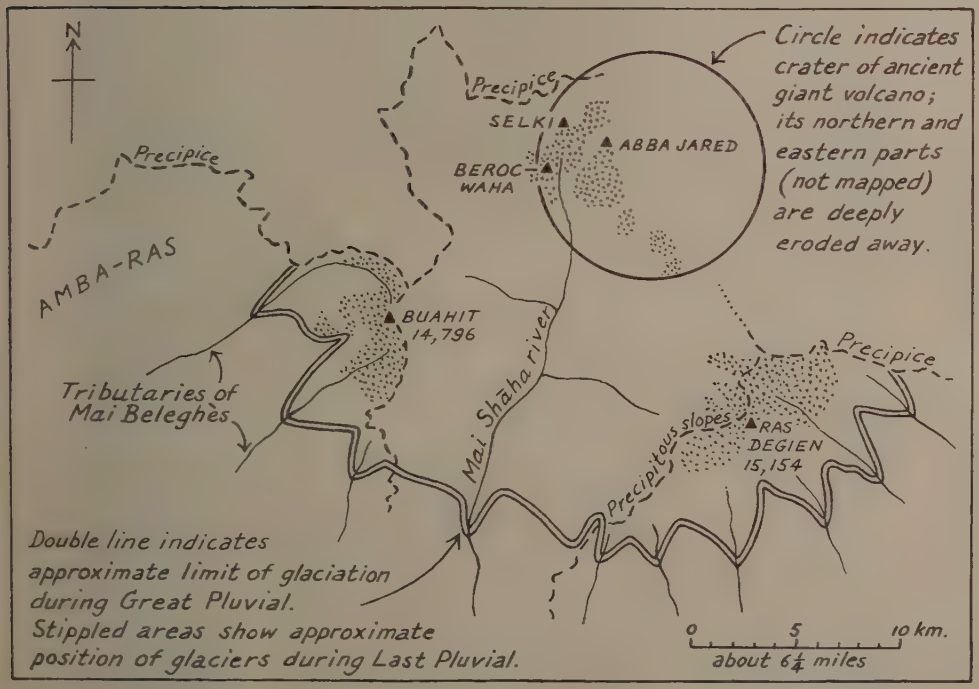


FIG. 2.—Traces of former glaciation in the highest part of Simien; also the ancient giant crater (adapted from Nilsson 1940, fig. 42, p. 61; 'Great Pluvial' and 'Last Pluvial' are respectively Kanjeran and Gamblian in present terminology.)

but more recently subdivided, are named, lies about 60 miles due east of Simien on the far side of the Tacazzé and near the highway leading south from Adua to Addis Ababa. Other limestone tracts lay nearer my route. These Jurassic limestones include fossiliferous beds. Moreover, Minucci (1938, p. 40) writes of more recent sedimentary deposits, containing ' a little fauna ' (*una faunetta*) of fossils, intercalated deep in the eruptive volcanic series, at Ataba, a village at about 5200 feet, some 11 miles north-east of Mt. Beroc-Waha ; these are possibly coeval with similar fossiliferous intercalations in the upper series of traps outside Simien at Amba Alāgi, about 80 miles south-south-east of Ataba.]

Comparatively recent volcanic formations of the Aden Series, consisting of basalts and trachytes of Pliocene and Pleistocene age, exist in several parts of Ethiopia, notably in the valley of the Hawash. Some of these later volcanoes still have active fumaroles. In the lower part of the Hawash valley eruptions appear to have occurred about 1810[13] ; while Dubbi, a volcano on the Danakil coast south of Edd, erupted as lately as 1861 (*Guida*, p. 45). (In central and eastern Africa some volcanoes are still active, e.g. Kilimanjaro and certain of the Virunga volcanoes in the Belgian Congo.)

The immense lapse of geological time covered by the older and more recent phases of volcanic activity comprised not only the duration of each phase, but the interval between. If the giant volcanoes and plateau-basalts of the Trap Series date from early Tertiary or possibly even Cretaceous times, and the whole Tertiary period is reckoned to have started between 60 and 70 million years ago, how much earlier may the formation of the Trap Series, if partly contemporaneous with the Cretaceous, have begun ?

Regarding the Pliocene-Pleistocene Aden Series, supposing the Pliocene to have begun (as is held) approximately 12 million, and the Pleistocene approximately one million, years ago ; at what point in the Pliocene did these volcanic outpourings begin ? And have they been continuous or intermittent ? Their last phase, at any rate, still manifests itself in Ethiopia by the phenomena of dying volcanic activity, and in central and eastern Africa by the active eruptive processes mentioned above.

Such estimates of time as the foregoing, though lacking precision, render it easier to appreciate Nilsson's remark (1940, p. 59) that erosion has been at work on the giant volcano of Simien since some point in (early) Tertiary time, its forces culminating in the Pluvial Epochs of the Pleistocene. Nilsson has also pointed out (1940, p. 49) that comparatively recent volcanic activity may have profoundly affected the region in another way, by bringing Lake Tana into existence. During the last Inter-Pluvial Epoch eruptions blocked the valleys of the north-western part of the Abyssinian plateau. Very probably the Lake Tana basin was formed then, and filled with water during the succeeding epoch, the Gamblian (or Last) Pluvial.

Relation of Simien to the Rift-Valley System ; Lake Tana not a rift-lake. As I stressed (1952, pp. 95 *seq.*), the high mountains visited on my earlier journeys are associated with the ' Galla Depression ', the part of the eastern branch of the Rift-Valley System slanting diagonally across Ethiopia from north-north-east to south-south-west, in which lies the chain of the Galla lakes, from Lake Zwai to Lake Chamo. (' Rift-Valley System ' is used as a comprehensive term for the immense system of fractures extending from the Jordan Valley to a

[13] I mentioned (1952, p. 95) several volcanoes of the later series possessing active fumaroles, as well as the frequency of hot springs. My attention has since been drawn to the thermal springs near Lake Afdera (or Afrera, or Giulietti), over 260 feet below sea-level in the southern part of the deep north-eastern Depression. Moreover D. R. Buxton (1949, pp. 143–144) describes ' lava-flows . . . startling in their freshness, resembling . . . twisted masses of stiff black treacle ', in the Garibaldi Pass (south-west of Metahara railway station). Buxton quoted Harris (1844) to the effect that volcanic outbursts had taken place about 1810.

point south of the Zambesi. It includes the troughs of the Red Sea and Gulf of Aden ; the Galla Depression slanting south-west across Ethiopia ; the Rift-Valley proper, extending from north to south across Kenya ; and the western branch, in which lie Lakes Albert, Edward, Kivu and Tanganyika. No opinion is ventured here about the relative ages and processes of formation of the component parts. In my earlier paper (1952, pp. 95–97) the term was used in the same sense and illustrated by a map adapted from J. W. Gregory.)

The section of the Rift-Valley System to which Simien and the adjacent highlands of northern Ethiopia are closest is apparently the trough of the Red Sea itself. The nearest part of its coast lies only about 170 miles north-east of the centre of Simien. These mountains and plateaux form part of the great series of high volcanic formations extending north from eastern Africa through Ethiopia into Eritrea and even farther. As such they are presumably associated with the eastern branch of the system, of which the Red Sea is a part.

Moreover Lake Tana, a large shallow lake which probably originated (as stated) through the damming of a wide depression by volcanic formations, does not lie in any rift. Some facts about the Lake, its altitude, size and depth, are given in Appendix 1 (p. 75), together with the differing views of Nilsson and Minucci on terraced formations in the surrounding basin. My visit in January 1953, only touching the north shore and, cut short by transport difficulties, was hardly more than an appendage to my main work in Simien.

Glaciation in Simien and other parts of Ethiopia : while existing glaciers and traces of former ones on the mountains of eastern Africa are well known, the traces of former glaciation discovered in Simien and other parts of Ethiopia have apparently been little noticed in British periodicals.[14] What has been discovered may therefore be usefully summarized.

There is at present no perpetual snow in Ethiopia, and at the time of my first visit (1926–27) it was not known how far, if at all, the highlands had been glaciated.

So far as Simien is concerned (leaving out for the moment traces of glaciation on other mountains in Ethiopia), three sets of researches have to be considered : those of Nilsson in 1932–33 (published 1940), of Minucci in 1937 (published 1938) and of Hövermann in 1953 (published 1954). Nilsson established that glaciation had occurred in more than one group of mountains, and, so far as Simien goes, Minucci (1938) agreed with his conclusions in principle, though differing in some details. Hövermann's conclusions, however, are widely divergent from those of his predecessors.

It is an important fact that glaciation did occur. I cannot judge between the differing interpretations of its traces, but would express my gratitude to Dr. Nilsson for his helpful comments in recent letters (vi–vii.1957).

Writing in 1940 he used the terms ' Great Pluvial ' and ' Last Pluvial '. These climatic phases are now called, respectively, the Kanjeran Pluvial and the Gamblian Pluvial. Moreover, since he considers that the pluvial phases of tropical latitudes were contemporaneous with the glaciations in high latitudes, he correlates the Kanjeran with the Riss Glaciation, and the Gamblian with the Würm Glaciation.

[Neither the correlation of pluvial phases in Africa with glaciations in Europe, nor their chronology, can be fully discussed here. Though complete agreement has not been reached, it appears probable that pluvial periods in the tropics were broadly contemporary with glacial phases elsewhere.

The newer names of Pleistocene phases are taken from places in East Africa but applied to the continent as a whole. The Kanjeran was named from Kanjera on the Kavirondo Gulf (Lake Victoria) and the Gamblian from a cave on Mr.

[14] I know only a brief citation of Nilsson's researches by P. C. Spink in *Geogr. J.*, **115**, p. 270, 1950. Spink's note was included (under ' Nilsson ') in my References (1952, p. 184).

Gamble's farm near Lake Elmenteita (Kenya Rift Valley). The northern glaciations with which Dr. Nilsson correlates these are the two later phases of the fourfold Alpine glaciation, termed respectively Gunz, Mindel, Riss and Würm.[15]

The Kanjeran has been referred to the late Middle Pleistocene, and the Gamblian to the Upper Pleistocene. The Gamblian may have lasted from about 70,000 to 10,000 years B.C. There is also evidence that, in Ethiopia and other parts of the ' Horn ' of Africa, two *post-pluvial wet phases* occurred, broadly contemporaneous with the Makalian (Epi-Pleistocene) and Nakuran (Recent) wet phases in East Africa, believed to have been, respectively, about 7000 and 800 years B.C. Though the Pleistocene and later wet phases doubtless caused a wetter climate in Ethiopia than at present, the climate may still have been drier than in eastern Africa, so that even in the mountains the effects on animals and plants were possibly more localized. But if insects and other invertebrates react to these changes as vertebrate animals do, many insects, etc., may have become extinct in the arid intervals between the wet phases (the above three paragraphs are mainly based on Chapter ii, ' The climatic background ', in Miss Cole's book, *The Prehistory of East Africa*, 1954).

Seeing the importance which identification of *fossil pollen-grains* has assumed, in providing a chronological sequence of events in the Quaternary, Dr. Hedberg's ' Pollen-analytical reconnaissance in Tropical East Africa ' (1954) should be the forerunner of useful work bearing on changes in vegetation zones during the pluvial epochs. The conditions for formation of deposits of pollen are different from those in northern latitudes. But no fossil pollen has yet (viii.1957) been recorded from Ethiopia.]

Nilsson found Simien so imperfectly mapped that he first surveyed an area of about 700 square kilometres (roughly 280 square miles), of which he concluded that about 440 sq. km. (nearly 170 sq. m.) were glaciated during the Kanjeran. and about 60 sq. km. (roughly 23 sq. m.) during the Gamblian (1940, p. 62). But these figures only represent the formerly glaciated part of the area surveyed, while the total extent of glaciation may have been larger. He found it more difficult to fix the limits of glaciation during the Kanjeran owing to the scarcity of moraine-materials, but easier to estimate its extension during the Gamblian, when there were apparently three groups of glaciers within the area mapped. The approximate limits of glaciation (within that area) in these two epochs are indicated in Fig. 2. Dr. Nilsson was not sure how far glaciation extended down the Mai Shāha valley during the Kanjeran ; he now thinks (letter, vi.1957) that it may have extended farther south and reached lower altitudes, more in accordance with Hövermann's conclusions.

According to Nilsson's table (1940, p. 63) of the height of the snow-line on several massifs in eastern Africa and in Ethiopia, the snow-line in Simien during the Kanjeran was at 4100 metres (about 13,450 feet), that is 520 metres (over 1700 feet) lower than the summit of Ras Degien (4620 m., 15,154 ft.). He concluded that in the Gamblian the snow-line would have been about 100 metres (328 feet) higher.

Nilsson was greatly impressed by the deep and broad valley of the Mai Shāha, the torrent which, rising in a vast *cirque* among the highest northern summits, runs almost due south for nearly 25 miles, before abruptly bending eastward to the Tacazzé.[16] He concluded that this deep canyon, cleaving high Simien unequally into a large western, and a smaller eastern, mass, and dispro-

[15] As far as glaciation in Europe goes, Dr. H. Godwin states (1956, p. 13) that it is not yet altogether agreed how far the stages of Scandinavian glaciation correspond with the Alpine stages ; and that, for Great Britain, there is not yet agreement on the number of glaciations, much less on their continental equivalents.

[16] This feature, an abrupt bend eastward, is repeated a few miles farther south by a larger tributary of the Tacazzé, the Mai Beleghès ; see map (Fig. 5).

portionately large for the river now contained in it, was produced chiefly through glacial erosion (1940, p. 59).

Nilsson had already made known parts of his findings in 1935, before the publication in 1940 of the work here cited. Meanwhile Minucci, who paid a brief visit to Simien in 1937 during the *Missione di Studio al Lago Tana*, regarded (1938, pp. 45, 46) the area formerly glaciated as less than Nilsson's estimate, and as consisting mainly of small glaciers descending from *cirques* or other slopes at most as low as 3800 metres (*c.* 12,460 feet). Minucci's and Nilsson's findings so far differ only in degree. The greatest discrepancy is that Minucci did not consider the Mai Shāha valley to have been formed by glacial action.

In contrast to the conclusions of Nilsson and Minucci, those of Hövermann (1954) seem revolutionary. The latter agrees, indeed, that traces of ancient glaciations are found in Simien, but at substantially lower altitudes than his predecessors thought. Thus, according to Hövermann, on the eastern margin of the highlands the snow-line may have been appreciably below 3000 metres (well under 10,000 feet) during the Gamblian (or Würm glaciation).

On the other hand, he regards the formations of the highest altitudes, hitherto held to belong to ancient glacial periods, as having been produced in very recent times, even during the 19th century. He considers that, from the 16th century onwards, observations in the narratives of travellers render it possible to trace fluctuations in the snow-line in Simien, not only in each century, but at intervals of only some decades ; these fluctuations corresponding with those of glaciers in the Alps. For instance, the snow-line was considerably below the highest summits of Simien during the first part of the 19th century, but receded later in that century. At the beginning of the present century the perennial snow-line seems again to have been below the summits for a short period, but it has since receded to an altitude above those summits.

Dr. Nilsson doubts whether glaciation in northern Ethiopia and Eritrea during the Gamblian occurred at such low levels as supposed ; if the traces be authentic, they could possibly have been left by the next earlier glaciation. Also, while recognizing that the height of the snow-line has varied during post-pluvial time, he cannot judge the reliability of these recent conclusions. He (Nilsson) considers that careful mapping of glacial remains of different ages throughout the whole of the highlands is needed before a true account of these glaciations can be given.

Though in 1952 I had read none of these writings, and knew only the bare fact that traces of former glaciation exist in Simien :—(*a*) It was comparatively easy to recognize exposed sections of consolidated moraine-material, such as the cliff composed of this material in the background of the lower photograph (Plate 1), in a lateral ravine in the Mai Shāha valley, west of the river. Dr. Nilsson considers the moraine material shown a good example, probably of the Kanjeran ; (*b*) the Mai Shāha valley, whatever its origin, seems disproportionately broad and deep for the river flowing in it ; (*c*) having seen in 1926, between Mts. Chillālo and Badda, formations subsequently recognized as glacio-fluvial, I surmise that numerous boulders of volcanic rock lying on the tops and flanks of rounded hog's-back ridges, especially in part of the Simien massif south of the area examined by Dr. Nilsson, may be derived from moraine deposits hidden beneath the soil, perhaps exposed by ploughing. But their glacial origin is not certain without examination by a geologist (certain kinds of weathering in the tropics produce groups of rounded rocks simulating moraines, some of which lie on the tops of ridges ; instances occur in eastern Africa).

[*Glaciation on other mountains in Ethiopia.* To my knowledge, of the three explorers whose work is reviewed above, only Nilsson has recorded (1940, pp. 55–57) the results of research in other parts of Ethiopia. The conclusions reached by

him in the limited time at his disposal may be briefly summarized. The situation of the mountains mentioned can be seen from the folding relief map.

Next to Simien, the surest traces were found in the Arussi mountains (south of Addis Ababa and east of Lake Zwai), where both Mount Chillālo and the high range to the east were glaciated. He found moraine-ridges finely developed in valleys on the west side of the high range, while the saddle between it and Chillālo, where some tarns lie, is covered by glacio-fluvial material. (I spent some time on Chillālo, one of my best collecting grounds for insects and plants, in November 1926, and passed hurriedly over the saddle connecting it to the high range. Nilsson calls the range Mt. Kaka, while I have usually called it Badda ; both names are found on maps, and both may be used for summits in the range.)

He found no traces of moraine on the Choké Mts.; but on Mt. Guna, east of Lake Tana, and on Amba Farit, to the south-east, some deposits may possibly be relics of moraines of the Kanjeran Pluvial. These lie at about 3700 metres (12,100 feet). The Mt. Guna here mentioned should not be confused with the other Mt. Guna, east of Lake Zwai, far to the south.]

Effects of topography and geological formation on the fauna and flora. These effects may be briefly considered before closing Part 1.

Apart from the extra high altitude, the geological structure in general, and especially the intrusive formations of harder rock, obviously affect animals and plants. For instance, the least accessible outlying bastions and ranges are almost the last refuge of the *walia* ibex, besides doubtless providing nesting places for hawks and falcons. The precipices, rock-gradines and ledges harbour troops of *gelada* monkeys. Moisture lingers in the dry season only in very shallow caves in vertical rock faces, or in the shadow of volcanic towers and dykes ; what such moisture means for plants, insects, etc. need scarcely be said. (The ' intrusive formations ' thrust themselves on a traveller's notice. He must surmount volcanic dykes, upstanding like rough, thick stone walls. And the mighty precipices enclosing the valleys of the Mai Shāha and the Mai Beleghès must be scaled by narrow, zigzagging mule-paths covered with loose stones, alternating with projecting gradines of harder rock, through which wind deep narrow staircases, worn and polished by the feet of men and pack-animals, where it is best to dismount and climb on foot, if not on ' all fours '.)

Effects of former volcanic eruptions and glaciation. On the other hand these agencies were probably localized in their effects.

Direct local destruction of vegetation and associated animal life by contact with molten lava did occur in Ethiopia in past geological periods (and still occurs in central Africa). For example, Nilsson (1940, p. 50) discovered the remains of a whole forest apparently destroyed thus and covered by lava 20 metres (nearly 66 feet) thick. This fossil forest lies above the buried sediments of an ancient lake, no longer existing as such, which he called ' Lake Yaya ', from its situation near the village of Yaya, on the southern part of the high plateau in Gojjam Province. Alternating layers of clay and sand, deposited on the plateau basalt, lie undisturbed to a thickness of over 11 metres (about 36 feet), while above them lie sediments containing abundant petrified tree trunks, in some cases over two feet in diameter, protruding from the sedimentary layers. (Nilsson first assigned Lake Yaya to the ' Great Pluvial ', but later considered that it probably existed even in the ' First Pluvial ' Epoch ;[17] 1940, pp. 52, 72).

It is more difficult to assess the effect on animals and plants of falls of volcanic dust and other atmospheric conditions after eruptions. These effects may be felt over much wider areas than is direct burning by molten lava.

Whatever effects geological and climatic changes as a whole may have had,

[17] The First Pluvial is now termed *Kageran* ; it is referred to the Lower Pleistocene (the name, derived from the *Kagera* River in Uganda, must not be confused with the Middle Pleistocene *Kanjeran*).

volcanic activity and glaciation were probably no more general or continuous in Ethiopia than in the rest of eastern Africa. It is unlikely that these agencies by themselves can account for the gaps in the fauna of high Ethiopia as compared with that of eastern Africa. This subject is briefly discussed below (p. 34), after a partial review of the high-mountain fauna.

Part 2: Biogeographical

Introductory remarks. In this Part the groups of invertebrates already examined by specialists are reviewed, and an attempt is made to indicate the affinities of the high-mountain fauna, and its relationship with the flora. The review of these invertebrates is preceded by a brief mention of some vertebrate animals, the presence of which in Simien, though well known, emphasizes the mixed character of its fauna.

As outlined in Part 1, outpourings of basaltic lava, beginning at least as far back as early Tertiary times, together with tectonic movements, produced an exceedingly thick block, uplifted and tilted, of stratoid basaltic rocks of the Trap Series. During an immense lapse of geological time this was subjected not only to erosion but, presumably from Pliocene times onwards, to the intrusion of later volcanic formations of the Aden Series. The erosive processes included phases of glaciation and associated climatic changes. As a result we have in Simien a great highland massif, relatively isolated, farther north and higher than any other mountains in Ethiopia. What animals exist there at present?

Human activities for centuries past have accounted for much. The mountain forest has been almost entirely cleared, though groves of giant junipers are preserved in the precincts of churches, and small patches of mixed forest remain in ravines so steep as to be difficult of access to a collector. The rolling uplands are ploughed and cultivated up to 11,000 feet, in some places even to 12,000 feet or higher; while grazing land extends, in suitable places, even higher than this (on 11 December 1952, I saw animals grazing below the Pass of Degien at about 14,000 feet). Even among the fields, however, slopes too steep to plough bear a dense scrub of tree-heath (*Erica arborea*), bush-*Hypericum* and other plants; while, above the tree-limit, large areas are covered with wild growth of stunted *Lobelia rhynchopetalum*, helichrysums, grasses and, in marshy spots, sedges.

The proportions of Tropical African, Mediterranean and other geographical components in the fauna cannot as yet be precisely stated. But the mixture of elements characteristic of several faunistic regions can be illustrated by the sharp contrasts seen in several groups of animals. An attempt may also be made to answer broadly the question asked long ago by the entomologist Raffray (see below, p. 37), whether the 'afro-alpine' component is more accentuated in Simien than on the other high mountains of Ethiopia?

Examples of affinities. Though I collected no vertebrate animals, the following examples are drawn from mammals and birds.

(I) Mammals: the genus *Capra* (goats and ibexes), to which the walia ibex (*Capra walie*) belongs, is northern. Simien forms a link in distribution between its representatives in southern Europe, and those in Persia, Tibet, the Himalayas, etc. The whole subfamily Caprinae, comprising sheep and goats, is mainly Palaearctic.

The principal contrast is between this northern form and *Theropithecus gelada*, the *gelada* baboon or monkey (whichever term be used).[18] This animal, equally

[18] The term 'gelada baboon' is commonly used, but the late R. I. Pocock evidently restricted 'baboon' to the genus *Papio*, for in a letter to me (1928) he wrote that 'these monkeys (geladas) are totally distinct from baboons'.

characteristic of Simien and far more numerous than the ibex, is confined to certain mountainous parts of northern and north-central Ethiopia.

(Though the troops of geladas seen in Simien were never in company with any other animal, yet in 1926 I had seen geladas and true baboons of the genus *Papio*[19] together on the precipices of the Muger valley, somewhat over 30 miles north of Addis Ababa. In the high altitudes of Simien, on the contrary, I saw no baboons of the genus *Papio* at all, though they were visible and audible in the lower country to the north ; for instance, beside the River Tacazzé, and a few miles below Asmara on the Massawa road. In 1927 several members of Dr. Osgood's party frequently saw geladas and walia ibex together in Simien, and were told by local people that the geladas act as sentinels for the ibex ; see Baum, 1928, p. 243.)

The smaller monkey occurring in Simien, *Cercopithecus aethiops* (almost certainly the form known as the grivet monkey), is also Tropical African (I only saw these animals at the edge of the Tacazzé and in the forest zone on the northern escarpment. Elsewhere I was probably too high up, and in country too bare of forest. As to the *guerèza* monkey (*Colobus*), I neither saw any, nor have I read of them in Simien. Considering the scarcity of forest, their absence from the higher levels seems natural).

A rodent between a rat and a mouse in size inhabits small warrens at an altitude slightly above 13,000 feet. It is diurnal in its movements (see below, p. 63, and postscript, p. 90).

(II) Birds : notes taken in the field were submitted to R. E. Moreau shortly after my return to England ; these remarks therefore concern only species the identity of which is not in doubt. The strongest contrast is the following : the Chough (*Coracia pyrrhocorax*), a northern species (ranging from the western coasts of Britain, over the mountains of central and southern Europe, the rocky islands of the Mediterranean and mountainous parts of North Africa, Arabia, etc., as far east as Persia), in Ethiopia occurs only in the north, and may even be confined to Simien where, having been asked to look out for it, I saw large flocks.[20] Yet on the same uplands could be seen small groups of the Wattled Ibis, *Bostrychia carunculata*, endemic to the highlands of Ethiopia.[21] As the flocks of choughs kept usually to arable land, while the ibis stalked about near streams, I did not in fact see the two species together, but in some cases only a few miles apart.

Another typically African bird seen as high up as the two foregoing, though in a quite different habitat, was the beautiful violet Tacazzé Sunbird (*Nectarinia tacazze*), frequenting the slopes of ravines covered with scrub of *Erica arborea* and other plants, up to 11,000 feet or higher.

Thrushes frequented the northern escarpment at Lori, above 11,000 feet, hopping about on the grassland. They were evidently of the species which I had seen at altitudes above 8000 feet on both my previous journeys, invariably settling on the ground ; the ' Ground-scraper Thrush ' (*Geokichla litsipsirupa simensis*, formerly simply *Turdus simensis*!).

(A few other birds, together with indications of local migratory movements and signs of nesting, are mentioned in my narrative below, pp. 51, 57, etc.)

Review of the collections of invertebrate groups. The following reviews are all based on the material collected :—

(III) Mollusca : little can be said about mingling of biogeographical components. But the material collected in Simien may be compared with that obtained in the Gughé Highlands (1948), and with the larger collection made by myself and Professor Omer-Cooper in 1926–27.

[19] I cannot say which species of *Papio* frequents the precipices of the Muger. *Papio hamadryas* is apparently common at any rate in the north of Ethiopia (cf. Blanford, 1870, p. 222). But before my visit to the Muger Valley in December 1926, Omer-Cooper and I had met with numerous baboons (*Papio* sp.) living under very different conditions in the dense coniferous Jem-Jem Forest (west of Addis Ababa). The skull of a specimen shot by Omer-Cooper later, south of Addis Ababa, was considered by Pocock to be ' certainly not *Papio hamadryas* ' but apparently a form of *P. anubis* (1928, letter already cited.)

[20] The above refers to the typical red-billed, red-legged species, not the yellow-billed Alpine Chough, which is not known from Ethiopia.

[21] In 1948 I met with this ibis (dark coloured with green reflections and white marks in the wings) farther south than it was previously recorded. I also noted some local folk-lore about this bird (1952, p. 141).

Three species of slugs discovered in the Gughé Highlands, at altitudes of 10,000 feet or more, were described as new by Dr. Quick (1954), who referred two to *Agriolimax* (*sens. lat.*) and the third to *Veronicella* (*sens. lat.*).[22] Also, specimens of a Veronicellid, recorded by Conolly (1928, p. 173) as '*Veronicella* sp.', were collected in Jem-Jem Forest, between 8000 and 9000 feet, in 1926. These may be montane forms, either isolated relicts of a temperate fauna (in the case of *Agriolimax*), or locally evolved from parental stocks at lower altitudes.

In Simien no slugs were obtained, though I searched and tried a slug-bait. They may exist there, though no place visited provided quite the same habitat as those where slugs occurred in the Gughé Highlands. Some places in Simien may have been too high, while, despite a short spell of bad weather at the end of November and in December, the ground was mostly too dry and on many nights the temperature fell near or below freezing point.

Having realized on my southern journey (1948) that *snails* are scarce on the acid peat-lands of the mountain tops, I was not surprised to find relatively few in Simien. In neither case has it been possible to get the material studied as a faunistic unit. Dr. L. Forcart has, however, made (1957) an elaborate study of three species of *Phenacolimax* (Vitrinidae), none of them new.

Melanism at high altitudes: I was struck by the unicolorous black hue of the body and mantle, seen through the translucent shell, in one species of *Phenacolimax*, the only examples of which were found at the highest point reached, on Ras Degien, above 14,000 feet. This colour, described by Forcart as bluish-black in the preserved specimens, contrasts strongly with the pale colouring of the body and mantle, respectively uniformly grey, or yellowish-grey with dark markings, in the other two species, both of which were taken 20 miles west of Degien, and 2500 to 3000 feet lower. A specimen collected in 1926 on the summit of Mr. Chillālo (at over 12,000, possibly about 13,000 feet) also has the mantle and body bluish-black. This latter was recorded as '*Vitrina* sp.' by Connolly (1928, pp. 165–166).

Forcart has determined the specimens from Degien as *Phenacolimax riepiana* (Jickeli). It is uncertain whether the specimen from Chillālo and those from Degien are of the same species. But there seems little doubt that both cases exemplify the known tendency of certain snails to a darkening of colour at high altitudes (a phenomenon also exemplified by a species of Diptera numerous in Simien, as recorded below, p. 25).

(IV) INSECTS: the following remarks are based on studies by specialists, either published or in the press; or on preliminary opinions about certain Orders and families not intended for publication as faunistic reports. In a review unavoidably incomplete, the space devoted to particular groups is proportionate to the light they throw on biogeographical questions rather than to the numbers of species or specimens obtained.

Terrestrial Coleoptera. The high proportion of this Order in the collection as a whole is indicated in Appendix 2, p. 78. Not only was more time spent on Coleoptera, but CARABIDAE and STAPHYLINIDAE naturally predominate at such high altitudes. The CARABIDAE have all been studied, the TRECHINAE by Dr. Jeannel (1954), the remainder by P. Basilewsky (1957).

The TRECHINAE, 111 specimens, represent seven species, all new to science (see Fig. 3). The remaining Carabidae number about 900 specimens, representing 25 species, five of which are new.

Excepting the genera *Trechus s. str.*, *Calathus*, *Peryphus* and *Amara*, believed to be of Palaearctic origin, the affinities are African, in one case (*Afrotarus raffrayi*) indicating a link with the highlands of South-West Arabia.[23]

[22] Dr. Quick had previously, after a preliminary examination of the specimens, given a slightly different opinion as to the generic position of the two *Agriolimax*, which I cited (1952, p. 106).

[23] The genus *Afrotarus* was recently separated from *Cymindis* to include this Abyssinian species and two others discovered on Kilimanjaro. A representative new species (*A. scotti*) was found in 1938 at high altitudes in the Yemen.

The northern genera extending to the African mountains are, on the whole, more poorly represented as one goes south. Thus, 17 endemic species of *Calathus* are now known from the highlands of Ethiopia, but none has been found south of Ethiopia. On the other hand, in *Trechus s. str.*, of which 15 endemic species are known from the highlands of Ethiopia, species have been evolved on Mt. Elgon in astonishing numbers (*ils ont pullulé d'une façon extraordinaire*, Jeannel, 1954, p. 181); while still farther south a single species (*T. sjöstedti*) has been discovered on Mt. Meru (this is now regarded as the only known member of its species-group; Jeannel, 1954, p. 183).

Other endemic *Calathus* and *Trechus s. str.* almost certainly await discovery in Ethiopia, on the high massifs not yet explored (cf. p. 6).

In *Trechus s. str.*, though some species are related to those occurring geographically relatively close (e.g., *T. gugheensis*, the southernmost hitherto found in Ethiopia, is related to one inhabiting Mt. Elgon), the relationships of others are less clear; these latter might be linked with groups of species inhabiting 'l'Égéide',[24] but certain characters, divergent in the species inhabiting each massif, indicate several independent lines of descent (Jeannel, 1954, p. 184).

FIG. 3.—Montane species of *Trechus* from Simien, between 10,800 and 13,000 feet. Left to right: *T. simienensis*, *T. degienensis*, *T. pilosipennis* (all × *c.* 16). These, like the other Simien species, are apterous, but have fully developed eyes.

It would seem that the ancestral stocks of African *Trechus s. str.* propagated themselves in damp forests at lower altitudes, while the existing groups of montane species began as colonies derived from such ancestral stocks, themselves now extinct. Much the same suggestion has been put forward regarding the Afro-Alpine Orthoptera (as I cited, 1952, p. 104) and some groups of plants (e.g., the giant lobelias).

It is believed that, while ancestral stocks of the African *Trechus s. str.* extended southwards, the tropical African species of *Plocamotrechus*[25] radiated northwards from a southern centre of dispersal, where its ancestral forms originated in the Tertiary. At the present day species of this genus are numerous at all altitudes in South Africa. It spread north (probably in the Miocene) and 'relict species'

[24] The term 'Aegeid' signifies a vast land-mass believed to have existed during the Secondary and Tertiary, but to have been broken up by the formation of the Aegean Sea during the Quaternary. Its present remnants comprise a large part of the Balkans, the Islands of the Aegean, and the western part of Asia Minor (Jeannel, 1942, p. 365, cited from E. Haug, 1911). The region is regarded as a centre of dispersal of groups of *Trechus* in central and south-eastern Europe and in western Mediterranean lands.

[25] The typical genus *Trechus s. str.* is placed in the Tribe Trechini, *Plocamotrechus* in a separate Tribe, Trechodini. Almost needless to add, no *Plocamotrechus* is known from Ethiopia.

to-day inhabit Kilimanjaro, the Aberdare Mts, Mt Kenya and the Ruwenzori range, being specially numerous in the last-named. My earlier remarks (1952, p. 99) need modification; *Plocamotrechus* and *Trechus s. str.* are not, in Tropical Africa, confined respectively to the mountains associated with the western and eastern branches of the Rift-Valley System. But the fact remains that, so far as known, no high massif of tropical Africa is inhabited by *Trechus s. str.* and *Plocamotrechus* both at once.

Basilewsky (1957) attributes the relative fewness (25 species) of the other Carabidae to the great majority having been collected at heights between 10,000 and 14,000 feet, 'en pleine zone alpine'; more precisely, in the scanty remains of coniferous forest, and above the tree-limit, where stunted *Lobelia rhynchopetalum*, *Helichrysum*, grasses and other plants extend still farther upwards. But in the montane character of the material lies its interest. The five new species, all found at great heights, comprise *Omotaphus simienensis*, related to a form inhabiting the Aberdare Mts and Mt Elgon; *Liagonum scotti*, related to a species inhabiting Mt. Kilimanjaro; and three new species of *Calathus* (one shown in Fig. 4).

Flightlessness; restriction to particular massifs. The 15 species of *Trechus s. str.* known from high Ethiopia are all flightless; in his descriptions, Jeannel writes simply 'aptère'. This applies to the two (*T. sublaevis* and *T. bipartitus*) discovered over 70 years ago by Raffray on Mt. Abūna-Yosef, to the four discovered on Mt Chillālo in 1926, to the single species (*T. gugheensis*) found in the Gughé Highlands in 1948, to the seven discovered in Simien in 1952, and even to *T. aethiopicus*, discovered in 1904–05 by Baron Maurice de Rothschild at a rather lower altitude (about 7200 feet, on the banks of the Little Akaki River, near Addis Ababa). Moreover, except the last-named (*T. aethiopicus*, which may prove more widely distributed) they are all apparently restricted to the massifs where they were found. Flightlessness is not universal in this genus, though other flightless species, for instance, several in north-central Europe, are known.

The species of *Calathus* occurring in high Ethiopia also have the hind wings atrophied. M. Basilewsky, who did not state this in the published descriptions, wrote (letter, 28.xi.1957) that such species as he has examined are completely apterous. He adds that many European species of *Calathus* are fully winged, but some have the wings reduced, or entirely absent, as in many of the montane species of the Alps and Pyrenees.

In *Calathus* again, many of the species occurring in high Ethiopia are known only from particular massifs. None of those previously discovered in Ethiopia was found in Simien. The four from Mount Chillālo (1926), and the two from the Gughé Highlands (1948), have not hitherto been found elsewhere than on their respective massifs. But other Abyssinian *Calathus*, occurring at somewhat lower altitudes, are more widely distributed.[26]

Flightlessness, and restriction to single massifs, are parallelled in some other families of Coleoptera inhabiting the high mountains of eastern Africa; e.g., out of 45 species listed by me in 1935 as peculiarly associated with giant lobelias and senecios, 22 have the wings either vestigial or atrophied (Scott, 1935, p. 243). Since that date other flightless species associated with these giant plants may have been recorded.

Analogy with flightless Coleoptera in remote islands: as stated, some of the flightless beetles of the African mountains belong to groups in which reduction or atrophy of the hind wings is widespread or general. The phenomenon may be compared with the high proportion of flightless Coleoptera in remote islands. Here, the original hypothesis used by Darwin, that flightless species would have a better chance of survival as they could not be blown out to sea, is no longer universally applicable. Many ecological and other factors must also be considered (see R. C. Fisher, 'A reinvestigation of flightlessness in the Coleoptera of Madeira': abstract in *Proc. R. ent. Soc.*, C, **22**, p. 35, 1957).

[26] ***Calathus aethiopicus***, discovered on Mt. Zuquāla (at about 9900 feet) and near Addis Ababa (at about 7700 feet), was later recorded from Mt. Termaber. I did not find this species on Zuquāla in 1926, but discovered there a closely related form *C. aethiops*, found again at a corresponding altitude on Mt. Damōta in 1948. Is *C. aethiops* a specialized form derived from *C. aethiopicus*, and discontinuously distributed (possibly separately evolved) on high summits at long distances apart?

' Regressive evolution ' in montane Coleoptera. The conclusions to which Narcisse Leleup has been led by his prolonged intensive work in the mountain forests of the eastern Belgian Congo[27] invite even closer comparison. His researches, in which Jeannel and Basilewsky have collaborated on the systematic side, were partly summarized (1956) in a fine work entitled ' La faune cavernicole du Congo Belge, et considérations sur les coléoptères reliques d'Afrique intertropicale '.

As to the first part of this work, briefly, Leleup considers that specialized cave-dwelling species were mainly evolved from ' humicolous ' species, i.e. those inhabiting humus on the forest floor at cool altitudes, where the temperature of the humus is nearly constant and the atmosphere saturated with moisture. In tropical latitudes a rich and very ancient fauna has survived in humus, together with highly specialized forms in caverns. But in Mediterranean latitudes the humicolous fauna inhabiting the moist tropical forests of the Eocene was mostly extirpated by subsequent climatic changes. The dry tropical Oligocene climate caused certain ancestral forms to penetrate under ground, where some lines of descent (*troglobies*) in caverns, others (endogaeous) in deep fissures in the soil, withstood even the glacial epochs. At present, the environment in which certain Coleoptera are most numerous in Kivu consists of extremely damp humus, having a constant cool temperature of about 10° C. (50° F.) at 10 centimetres (4 inches) below the surface. This is almost identical with the humidity and temperature, scarcely varying throughout the year, in many caverns in southern Europe.

The present paper is not directly concerned with cave fauna, of which I obtained no example, though discoveries doubtless await collectors in limestone districts of Ethiopia. But I am closely concerned with Leleup's second part, his *considérations* on the ' relict ' Coleoptera of Tropical Africa. For, as shown above, some montane beetles of Ethiopia (*Trechus, Calathus*) show the first stage of what he expressively terms ' regressive evolution ', namely atrophy of the hind wings.

In Simien I found no Coleoptera exhibiting further stages of regression, such as reduction or total atrophy of the eyes, or reduction of pigment. In southern Ethiopia, on the other hand, examples *were* found, e.g. the minute Anillini, depigmented, with eyes either vestigial or absent (see my paper, 1952, p. 101), or the totally anophthalmous Pterostichine, *Caecocaelus scotti* (Fig. 4), found beneath a boulder, at nearly 9000 feet, west of Lake Abaya (the species of *Caecocaelus* not only lack eyes, but are also flightless, as far as Dr. Straneo has been able to determine from the few examples known).

Caecocaelus is unlikely to occur in northern Ethiopia, as the known forms are restricted to southern Ethiopia and the mountains of Ruanda and Kivu, on either side of the western branch of the Rift-Valley System. But representatives of the endogaeous tribe Anillini (Carabidae, Bembidiinae) will almost certainly be found in northern Ethiopia, probably members of the Europeo-African species-group of the sub-tribe Scotodipnina ; for the Anillini hitherto discovered in southern Ethiopia and on Mts Kenya and Kilimanjaro, as well as on the Ruwenzori and other ranges of the Belgian Congo, all belong to this sub-tribe and to the species-group named, being apparently southern extensions from Mediterranean lands (Jeannel, 1957, pp. 59–64 and fig. 90). In Simien suitable humus may exist in places somewhat lower than my route ; perhaps in the upper forest on the northern escarpment but, in ascending the Wolkefit motor-road, I scarcely saw a spot which would have offered a foothold for collecting while to halt in the forest belt would have been inadvisable for ' security ' reasons.

[27] Monsieur Leleup's centre under IRSAC (Institut pour la Recherce Scientifique en Afrique Centrale) is at Uvira, near the northern end of Lake Tanganyika. He has also visited mountains, including Elgon, in British territory.

PSELAPHIDAE are not usually found at such high altitudes. Unfortunately I could collect none lower down, for comparison with those of the Congo mountain forests, where these bizarre beetles present many stages in regressive evolution (cf. figures in Leleup's work).

ANTHICIDAE: beetles inhabiting high altitudes do not always show signs of regression. An Anthicid, *Endomia picina*, discovered in Simien between 11,500 and 13,200 feet, is fully winged and has normal eyes; whereas Leleup discovered the first apterous and eyeless member of this usually flower-haunting family in humus on Mt. Elgon (*Elgonidium leleupi*). Some specimens of *Endomia picina*

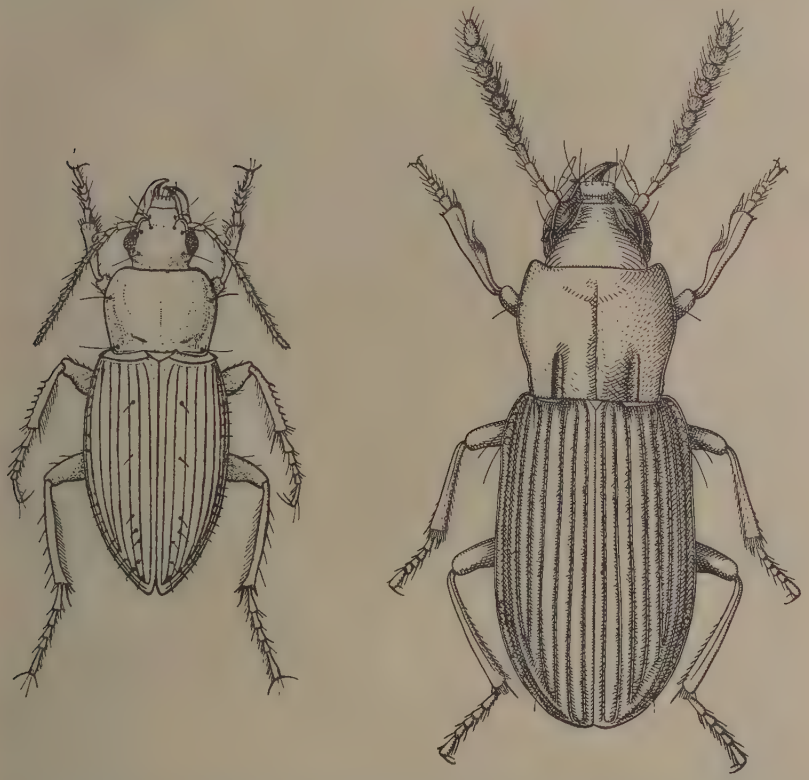


FIG. 4.—Left, a montane species of *Calathus* (*C. ras*, × 6) from Simien (12,000–14,000 feet); wings atrophied but eyes fully developed. Right, *Caecocaelus scotti* (× *c.* 20) from southern Ethiopia (*c.* 8900 feet); in this subterranean genus both wings and eyes are atrophied.

were in the tunnels of a small rodent, but not far enough to be subjected to carbon dioxide sufficient to influence atrophy of the eyes, as a strong concentration of this gas in the nests of mammals appears to do (Leleup, 1956, p. 123).

Some of the montane Carabidae were locally very abundant. Thus, 269 specimens of *Calathus simienensis* were collected, and 325 of *Omotaphus simienensis*. *Peryphus muscicola*, not confined to Simien, but first discovered on Mt. Damōta (1948), is represented by 86 examples.

A few more widely spread species of Carabidae were obtained at lower altitudes. For example, series of *Clivina natalensis* and *Tachyura conspicua*, both widespread in eastern and southern Africa at moderate or low altitudes, were collected in the

bed of the Tacazzé River (about 2600 feet). Other instances will be found in Basilewsky's report (1957). Of the subfamily Carabinae, only a solitary specimen of *Caminara chlorostictum*, widely distributed in eastern and southern Africa, was found. Some other species (not new), e.g. *Chlaenius dinodoides* and four *Harpalus*, are hitherto unknown outside Ethiopia, though widely distributed at moderately high altitudes in that country.

STAPHYLINIDAE: no general faunistic account of this family has appeared. But a work treating mainly of the genus *Xylostiba* was published by G. Fagel (1956). As these forms related to *Omalium* are largely associated with giant lobelias, remarks on them are given below (p. 73–74). Other relevant works by Fagel are included in the Bibliography (p. 82–83).

Flower-haunting beetles were on the whole scarce or, in some families, absent; especially CORYLOPHIDAE, CRYPTOPHAGIDAE and the genus *Biphyllus*. A list given below (p. 73) of insects associated with *Lobelia rhynchopetalum* indicates that few species of Coleoptera were found in the inflorescences or crowns of leaves. No list of lobelia-haunting beetles could be drawn up for Simien comparable with that for eastern Africa and southern Ethiopia (Scott, 1935). Yet in Simien, though the early months of the dry season were in progress (despite thunderstorms at the end of November), there was no lack of flowers, *Lobelia rhynchopetalum*, *Helichrysum* spp., etc. The nights may have been too cold; or some of the beetles named above, so abundant farther south, may be really absent from high Simien.

The flower-haunting genus *Meligethes* (Nitidulidae) exemplifies the fact that beetles inhabiting high mountains, but retaining full development of the hind wings, may be widely distributed. According to preliminary information from Dr. A. M. Easton, 45 specimens were collected in Simien, representing six or seven species. Only two, originally described by Grouvelle from Abyssinia and East Africa respectively, were previously known. The others are all new to science, but not confined to the Simien massif, all but one having been also obtained during my earlier journeys. The species recorded from Ethiopia do not form an isolated group, but include members of several species-groups well represented in Africa south of the Sahara, as well as in Arabia.[28]

WATER BEETLES: preliminary remarks kindly furnished by J. Balfour-Browne (who is completing a study of the combined collections from Simien and the Gughé Highlands) show that the Simien collection comprises: HALIPLIDAE, one widely distributed Palaearctic species (*Haliplus lineatocollis*); DYTISCIDAE, 14 species, representing seven genera; HYDROPHILIDAE, 15 species, representing probably nine genera (the generic status of some species is not settled).

The affinities are varied, but both Dytiscidae and Hydrophilidae include forms of Palaearctic as well as African relationships, and a montane element, probably more pronounced in Hydrophilidae. Both collections include forms new to science.

A stronger resemblance exists between the Dytiscidae from High Simien and those from the Gughé Highlands (490 miles distant), than that existing between the Hydrophilidae from the two massifs. The Gughé Highlands journey yielded 15, the Simien journey 14, Dytiscidae.

Only four Hydrophilidae are common to the collections from the two journeys. The Hydrophilidae from the Gughé Highlands include only two Hydraeninae out of 21 species, while the Simien collection contains seven Hydraeninae (five of them new) out of 15 species. But this is probably due more to the different types of environment than to a real faunistic distinction. The relatively gentle undulations on top of the Simien massif are drained by streams descending not too steeply, for instance, those at Debārec, flowing between steep clay banks; but I found no such habitat for water-beetles at a corresponding altitude in the Gughé Highlands.[29]

[28] Reporting in 1954 on *Meligethes* from South-West Arabia, Dr. Easton found the collection to consist of 49 specimens representing five species, all but one new.

[29] An interesting paper by Miss Dorothy J. Jackson (1956) on dimorphism of the metasternal wings in certain Dytiscidae of the genus *Agabus*, and its relation to their capacity for flight, is based largely on specimens of *Agabus raffrayi* collected in 1948, respectively on Mts Damōta and Gughé. On Mt Damōta the beetles were found out of the water, as I recorded (1952, p. 135).

LEPIDOPTERA RHOPALOCERA: fifty-five specimens have been named by Mr. A. G. Gabriel. Their fewness is due not only to the difficulty of combining capture of butterflies with intensive search for small Coleoptera, etc., but still more to the natural obstacles presented by the country. Even the young and nimble men with me could hardly chase butterflies, restless in the hot sunshine, and often in strong wind, over the rock-strewn ground of Simien.

Though butterflies were found at places above 11,000 feet, especially along the south-eastern slope of the ridge of Ambaras in November, none were seen at higher altitudes. At the highest point reached, above 14,000 feet on Degien, 11 December, I particularly noted their absence; the sun was hot, the air cold in the shade and the soil dry, while the little cascades were frozen. Insects in general were scarce.

Nevertheless Mr. Gabriel's (unpublished) list amounts to 18 species or named forms, almost all characteristic of the highlands. They include, as elsewhere in Ethiopia, northern species which appear abruptly when the high plateaux are reached. But some components of this northern element differ from those found in southern Ethiopia. Several of these northern forms, found at Asmara, *c.* 7600 feet, in October, reappeared more than 150 miles south, at over 11,000 feet, in Simien in November.

Such northern forms are: *Colias electo* (related to our Clouded Yellow); *Pontia daplidice aethiops* (Ethiopian form of the Bath White), common at Asmara and elsewhere, but very difficult to capture;[30] and *Lycaena phlaeas pseudophlaeas* (Ethiopian form of the Small Copper), fairly common in gardens as Asmara, but also difficult to capture, though at Aberghinna, on the Ambaras ridge (Simien), over 11,000 feet, on 20 November, five examples were collected on a bare, stony eminence early in the morning, before the wind rose.

The above three northern species also occur in the highlands of South-West Arabia, either in the identical form found in Ethiopia, or as closely related forms. Thus, several forms of *Colias electo* are found in Arabia, also the identical Ethiopian form (*aethiops*) of *Pontia daplidice*; while *Lycaena phlaeas* is represented by the subspecies *shima* Gabriel, allied to the Ethiopian form *pseudophlaeas* (Gabriel, 1954, pp. 365, 372–373, 388).

Pararge maderakal, a dark-hued Satyrid, should probably also be reckoned a northern component, apparently restricted to the northern parts of Ethiopia and Somaliland,[31] and represented in Arabia by an allied species, *P. felix* (Gabriel, 1954, p. 353). Many specimens of *P. maderakal* were flying wildly on bare rocky ground, at over 11,000 feet, on Ambaras, 20 November (apparently in perfect condition, but mostly damaged in capture). Satyrids frequenting the hôtel garden at Asmara were probably of the same species, but I obtained no specimens. The only other Satyrid[32] is a single example (♂) of *Melanitis libya*, from Debārec, 9800 feet, 15 November; a species widely distributed in Tropical Africa, but not abundant in most parts of Ethiopia (Hale Carpenter, 1935, p. 354).

The cosmopolitan *Vanessa cardui* (Painted Lady) was very numerous in Asmara in October, much less so in late January. Many were visiting stalkless thistles on grass slopes at over 11,000 feet on Ambaras, 19–20 November. This species was equally abundant in southern Ethiopia in 1948 (Scott, 1952, pp. 138, 153).

Argynnis hyperbius neumanni, the handsome 'fritillary', was not seen at all and is not apparently recorded from Simien [33] (compare its occurrence on mountain tops in southern Ethiopia; Scott, 1952, pp. 134–135).

[30] In 1948 I took this *Pontia* as far south as the mountains north of Gardulla, south-west of Lake Chamo (Scott, 1952, p. 153).

[31] Hale Carpenter (1935, p. 356) gives 'Abyssinia and northern Somaliland', without details, for *P. maderakal*.

[32] I had collected several other Satyrids in the south; in 1948, two species of *Yphthima* in Gāmo Province, and a *Mycalesis* (*M. safitza aethiops*) in the same province at above 9000 feet; also a third *Yphthima* in 1926 on Mt. Zuquāla and near Lake Zwai (Hale Carpenter, 1935, p. 356).

[33] If *Viola abyssinica* be its food-plant as surmised, this plant may also not occur in Simien; I saw none.

Among characteristically African butterflies, *Acraea encedon necoda* abounded at Debārec, 9800 feet, in November (in October 1948 it was common in gardens at Addis Ababa, *c.* 8000 feet), but I met with no other *Acraea*. Only one species of *Antanartia* was found, *A. abyssinica*,[34] in treeless country, by a nearly dried-up stream above 11,000 feet, 19 November ; a very different spot from the well-timbered places usually favoured by Antanartias (some of which are superficially like the Red Admiral, though smaller).

It may be noted that no PAPILIONIDAE were seen.

An instance of migration : Anaphaeis aurota, a white Pierid with dark veins, a well-known migrant, was migrating from west to east, against or across the wind, in Asmara for several days in late October ; many specimens appeared, though at fairly wide intervals.

HYMENOPTERA ACULEATA : in the small number collected, most of the Aculeates have been named by Dr. L. Berland, some by Dr. I. H. H. Yarrow. Dr. Berland wrote (letter, 24.ix.1954) that the material contains a mixture of Mediterranean and Tropical African forms.

As Mediterranean he instanced *Bembex mediterranea*, which frequented the hôtel garden in Asmara in October 1952 ; also two species from Simien, *Astata* sp. (near the European *A. boops*) and *Psammophila hirsuta*, collected respectively at about 10,500 and 11,500 feet. An example of the Palaearctic *Philanthus triangulum* was taken at Derasghié, in southern Simien, at nearly 10,000 feet (the *Psammophila* and the *Philanthus* are not merely Palaearctic, but occur in Britain).

Among the ' true wasps ', *Polistes marginalis*, common throughout the Ethiopian Region and in North Africa, and *Belonogaster junceus* (Tropical Africa) were both numerous at high altitudes, visiting *Lobelia rhynchopetalum*, apparently for the moisture between the bases of the leaves (see below, p. 73). A solitary form (*Odynerus* (*Rynchium*) *silaos* var. *asmarensis*), relatively numerous above 10,000 feet, was originally found in Eritrea.

Only two Pompilidae, both African, were taken : *Cyphononyx flavicornis* (widespread in the Ethiopian Region), below Asmara, at about 6800 feet, and *Hemipepsis dedjaz* (West Africa, Uganda and Ethiopia), on the Ambaras ridge in Simien, above 11,000 feet. A Sphegid (*Crabro* (*Dasyproctus*) *oedignathus*), shaken from an aromatic Labiate shrub (*Becium grandiflorum*) in the Mai Shāha valley, above 9000 feet, is apparently known only from Ethiopia, having been discovered in Jem-Jem Forest (west of Addis Ababa) in 1926.[35]

Ants are absent from the highest altitudes and not usually found above 8000–9000 feet. Yet I found workers of two species (*Engramma ilgi* and *Acantholepis capensis*), both widely distributed in eastern Africa, in stiff, damp soil beneath boulders sunk in turf, at about 10,500 feet, on the Degien massif ; the latter were also collected in the ' middle altitudes ', at about 7000 feet, in 1926. Other cases of ants reaching great heights in Ethiopia are, however, recorded.[36]

DIPTERA : facts of particular interest in the material collected are :—

(*a*) The discovery of a new species (*Binorbitalia triseta*) of wingless SPHAEROCERIDAE (BORBORIDAE), congeneric with two others, inhabiting respectively the Gughé Highlands and the Aberdare Range (Kenya) ; so three representatives of this genus (*Binorbitalia*) occur on as many high massifs, separated by two gaps each of about 500 miles from north to south (the Simien species was found only in decaying stems of *Lobelia rhynchopetalum*, at 12,000 feet and higher). The two species of *Binorbitalia* from Ethiopia were described (1954) by O. W. Richards, who previously described (1951) the only other apterous Sphaerocerid known from Ethiopia (*Lobeliomyia scotti*), discovered on Mt. Chillālo in 1926 (also in a decaying stem of *Lobelia rhynchopetalum*).

[34] *Antanartia abyssinica* is distributed ' from Kilimanjaro to Abyssinia and Ruwenzori ' (Hale Carpenter, 1935, p. 372).

[35] Described by G. Arnold (1933, p. 355) under the genus *Thyreopus*.

[36] Compare my list, based on descriptions and determinations by Santschi, Crawley & Donisthorpe, *Ann. Mag. Nat. Hist.* (10) **12**, pp. 102–109, 1933. A form of *Camponotus* (*Tanaemyrmex*) *thraso* is there recorded from the summit of Mt. Chillālo.

Doubtless many wingless Sphaeroceridae remain to be discovered in the highlands of Ethiopia, though perhaps less numerous than those of Mt. Elgon,[37] where they are specially developed, or in the mountain forests of the Belgian Congo. The family includes numerous flightless representatives, either brachypterous, with wings so reduced that flight is impossible, or apterous, with both wings and halteres quite absent. Flightless species occur in many countries, not only at high altitudes, having apparently evolved from numerous parent-stocks; especially in rigorous climates, as on high mountains or in the subantarctic islands; also in protected situations, such as nests of mammals or dense plant-débris.

In a later paper (in the press), Professor Richards enumerates nine species of fully winged Sphaeroceridae, representing three genera, collected in Simien. Three species are described as new, and several of those previously known are hitherto recorded only from Ethiopia.

(*b*) The congregating of a species of CHLOROPIDAE, *Thaumatomyia secunda*, in immense numbers in the inflorescences of *Lobelia rhynchopetalum*, so that little dark flies flew out, literally in clouds, in every place where I worked among these giant plants. This Chloropid is congeneric with *Thaumatomyia notata*;[38] a frequent component of swarms of small Diptera in buildings in Europe; the cause of these swarms is not fully understood, nor can the reasons advanced to explain the congregating of Diptera, as well as insects of other Orders, be discussed here. But the swarms of *T. secunda* in Simien occurred in the open, far from native huts, and the flies took shelter almost exclusively in the lobelia-inflorescences, only to a very small extent in other vegetation (five specimens were also beaten from tree-heath on one occasion). I have once seen an outdoor swarm of the related *T. notata* in England, when several hundred specimens were hovering round a fragrant clematis on a house-wall, but the flies, though apparently attracted, did not settle on the flowers or leaves, but penetrated among the woody stems near the wall, as though seeking shelter. The congregating indoors of these flies may therefore have originated in swarms out-of-doors, even in this country (Scott, 1945).

The female sex evidently preponderated in the swarms of *T. secunda*, for a sample of 578 specimens collected in one place (at Arghine, above 11,000 feet, late in November) consisted of 419 female and only 159 male examples, a proportion of roughly 2·5 to 1. The female sex also preponderates in some swarms of *T. notata* in Europe.

Melanism. This material of *Thaumatomyia secunda* illustrates the tendency to darkening of colour with increasing height. Dr. Sabrosky, who identified the species, previously (1951, p. 734) compared specimens taken on Mt. Elgon at altitudes between 7000 and 9500 feet with a long series from Managasha (west of Addis Ababa) collected at nearly 10,000 feet;[39] these latter vary in colour but are on the whole darker than those from Mt. Elgon. But those from Simien, amounting to more than 600 specimens from heights between 10,000 and 14,000 feet, are (as he tells me in a letter, 22.viii.1955) the darkest which Dr. Sabrosky has seen. (The finding of a melanistic snail in Simien at above 14,000 feet may be recalled; *antea*, p. 17.)

(*c*) CULICIDAE: no *Anopheles* were seen during the whole journey, and in Simien itself I found no mosquitoes at all. But my lowest camp, in the upper Mai Beleghès Valley (late December) lay at a little over 7000 feet, while the other camps, in November and December, lay at altitudes between 9800 feet and over 11,000 feet.

Before and after the trek in the high mountains I collected the following: during October, in my room at Asmara (*c.* 7400 feet), *Culex pipiens* subsp. *fatigans* was fairly numerous (1 ♂ and 11 ♀ collected). Whatever be the usual habits of this mosquito, in this case they never bit until after the electric light was extinguished. At the end of January they were still present though less numerous.

[37] Compare the extreme degree of speciation on Mt Elgon among the Trechine Carabidae, mentioned above (p. 18).

[38] Earlier referred to as *Chloropisca notata*.

[39] The Managasha specimens, collected in May 1914 by the late O. Kovacs, are in the British Museum.

At Gondar (*c.* 7200 feet), 9–12 January, in my room at night: *Culex pipiens* subsp. *pipiens* (1 ♀), *Culex andersoni* subsp. *abyssinicus* (1 ♂, 1 ♀), and *Theobaldia longiareolata* (1 ♀); but I was, at any rate, not conscious of being bitten.

At Gorgora, on the north shore of Lake Tana (*c.* 6000 feet), the following were obtained by sweeping in a large marsh on the morning of 15 January: *Taeniorhynchus uniformis* (2 ♂), *T. africanus* (1 ♀), and *Uranotaenia* sp., possibly *U. balfouri*, (1 ♀). None of these were on the wing, and the females did not bite.

Major P. F. Mattingly, who named the specimens, remarked (vi.1955) that, considering the altitudes and the season, I obtained much what he would have expected. Regarding *Culex pipiens*, the common domestic gnat, Holarctic in distribution, he has written (1954, pp. 60–61) that it is represented in Africa south of the Sahara by the typical form, usually restricted to high altitudes in the tropics, and the tropical subspecies *fatigans*, occurring at lower altitudes.[40] I collected the subspecies *fatigans* at about 7400 feet at Asmara, and the typical form at nearly the same altitude (about 7200 feet) at Gondar; but though Gondar is roughly 200 miles south-south-west of Asmara, both places lie at intermediate altitudes, where the two forms may overlap.

The above data are recorded owing to the importance attaching to Culicidae. But the material collected throws no light on the special problems presented by the Culicidae of Ethiopia as a whole; such as the occurrence in that country of isolated populations of a mainly West African species, or the restriction of certain remarkable forms to areas of recent volcanic activity (Mattingly, 1954, pp. 53, 58, 59).

(d) *Larvae of Blepharoceridae apparently absent from torrents; Simuliid larvae present:* from their association with swift streams and waterfalls in mountainous districts, the 'net-veined midges' might be expected to occur in Ethiopia, while their notably discontinuous distribution in many parts of the world would add interest to their discovery. Since their strange onisciform larvae are fixed by suckers to rocks or to the faces of waterfalls, I have searched in places where, when the streams are low, only a shallow current flows over the smooth basaltic rock, places usually difficult of access, since many streams lie in steep-sided, narrow ravines, and even waterfalls only a few feet high drop into deep pools, where one step may take a man out of his depth.

At one such fall, on the Mecāna torrent at an altitude over 9000 feet, the vertical face being inaccessible, though no Blepharocerid larvae were found, countless larvae of buffalo-gnats (*Simulium*), in various stages of development, covered the rocks above the fall. So far as identification is possible from larvae alone, they were determined by Mr. P. Freeman as *Simulium aureosimile*, a species widely distributed in Tropical Africa (erroneously referred by several writers to *Simulium nigritarsis*).

(e) *Larva of Tabanus kingi:* the finding of larvae of this species, unusual in its habits in the genus *Tabanus*, under clear water at the edge of the River Tacazzé in January, is mentioned in the narrative (p. 53).

(f) *Diptera Calyptrata:* Dr. van Emden has recently (October 1957) completed a study, now in the press. Not a principal aim of my collecting, the Calyptrata amount to only 36 specimens. Yet from among this small material he has described three species new to science, and also a well-defined Abyssinian subspecies of a *Limnophora* (Anthomyiinae) of which the typical form was discovered on Mt Elgon. As a point of biological interest, 19 specimens of a new *Atherigona* (males and females) were part of a number hovering near a quarry-face, not in the deepest shadow cast by the rock, but at a distance intermediate between the rock-face and the bright sunlight—a distance where temperature and light were, presumably, 'just right'.

ORTHOPTERA: the ACRIDOIDEA were named by Dr. V. M. Dirsh early in 1956, together with those collected on my journey to the Gughé Highlands (1948–49). In comparing these two small collections, earlier work on the Acridoidea of the Ethiopian highlands should be borne in mind, particularly Dr. Uvarov's account (1934) of those obtained in 1926–27.

[40] *Culex fatigans* is now regarded as a subspecies of *C. pipiens*, as the two interbreed (Mattingly, l.c.).

The material collected on my northern journey (mainly in Simien) includes representatives of 13 species ; that from the southern journey (Gughé Highlands, etc.), 16 species. Since five species are represented in both collections, the total number is only 24. None is new to science.

A broad distinction exists between highland and lowland species, but there is in this material no grasshopper restricted to a single mountain massif. However, no grasshoppers at all were found at the highest altitudes visited on my three journeys. The highest points at which I collected any were :—about 10,000 feet on Mt. Chillālo, on short turf just at the upper limit of forest (November 1926) ; at about 10,600 feet on Mt. Tola (Gughé Highlands, December 1948); at a little under 11,000 feet in Simien (November and December 1952). If, as appears, their range stops short below 11,000 feet, there may have been no opportunity for specific or subspecific forms to be evolved through isolation in the highest zones of mountain vegetation.

Apparently the conclusions reached by Dr. Uvarov in 1934 will be, in the main, borne out : that the brachypterous forms and others restricted to high altitudes have developed from local African parental stocks inhabiting lesser heights, rather than from Palaearctic ancestral stocks (compare remarks above about Trechine Coleoptera, etc., pp. 17–19).

The following statements refer exclusively to the material collected in 1952–53 : (*a*) during my hurried visit to the north shore of Lake Tana in January 1953, I obtained four species in or near a marsh at the edge of the lake (6000 feet) ; two (*Oxya hyla*, *Trilophidia angustipennis*) are widespread in Africa, the other two (*Paracinema tricolor tricolor*, *Ailopus thalassinus*) even more widely distributed, their range including the Mediterranean or elsewhere in Europe. (*b*) The last named (*Ailopus*) was also abundant in the southern part of Simien, but at a moderate altitude, *c.* 7000 feet, in a valley near Dabāt. (*c*) Almost all the other species from Simien were found at higher altitudes, e.g. 25 examples of *Calephorus compressicornis*, a mainly Mediterranean species, were captured at Khabau, near the edge of the northern escarpment at about 10,500 feet, on 18 November ; others were found near Mecāna-Abbo and elsewhere, at 10,500 feet or higher, in December (e.g. *Gastrimargus rothschildi montana*, *Pycnodictya galinieri*). *Acrida bicolor* also occurred at 10,500 feet, but in December 1926 I had collected examples at only 5500 feet in the Muger Valley ; evidently it ranges through some thousands of feet, from savanna to montane conditions.

Collecting sometimes yields freakish results ! A single brachypterous male specimen from Jem-Jem Forest, above 8000 feet (ix.1926) was doubtfully referred by Uvarov (1934, p. 612) to *Neritius* as '*N. abyssinicus*, sp. n.' This species was not re-discovered till November 1948, when I collected a single female far to the south, at Sōddu (Walāmo Province), 6800 feet.

Lastly, a cluster of nymphs in the hopper stage, apparently *Phymateus* sp., was found in Simien on the east side of the Mai Shāha River, near the ford, at 9300 feet, 8 December. (No adult *Phymateus* was seen in Simien, though I had obtained a specimen of the brightly coloured *Ph. viridipes* at Wubara, Gughé Highlands, *c.* 8500 feet, December 1948.)

TETRIGIDAE : in Simien only one specimen, unfortunately unidentifiable, was collected near a spring at about 10,500 feet, south of Atgheba Ghiyorghis, in December 1952. On my southern journey, in November 1948, four female examples of *Paratettix africanus* were collected on the wet earth-face of a spring, on a turf-covered ridge near Ezo, at about 9600 feet. Both cases showed the predilection of many of these insects for moist places, also shared in varying degree by certain of our native British Tetrigidae.[41]

TETTIGONIIDAE and GRYLLIDAE (long-horned grasshoppers and crickets) : only six specimens in all, representing two species of Tettigoniidae and two of Gryllidae, were collected. This is perhaps not surprising, considering the high

[41] On the southern journey a female specimen of *Dasyleurotettix infaustus* was also obtained : Sōddu, Walāmo Province, about 6800 feet. These Tetrigidae, which Dr. Ragge has examined, had not previously been identified.

altitudes and sparseness of tall scrub or forest in Simien. The three species definitely named are more or less widespread. The only one found at a great height was *Homocoryphus nitidulus*, from about 10,900 feet near Atgheba Ghiyorghis. *Conocephalus conocephalus*, *Oecanthus macer* and an undetermined species of Nemobiinae were obtained near the north shore of Lake Tana at Gorgora, 6000 feet. Dr. D. R. Ragge kindly named the specimens.

DIPLURA: among primitive wingless insects a new monotypic genus (*Scottojapyx*) of JAPYGIDAE has been described by M. J. Pagés, whose paper (1957) also contains descriptions of new species of two genera collected in the Gughé Highlands in 1948.

Having to limit my efforts, I did not try to collect COLLEMBOLA. My impression is that few species occur at the highest altitudes, but individuals are numerous in some habitats, such as the humus at the base of dead stems of *Lobelia rhynchopetalum*.

THYSANOPTERA: the small number of thrips collected, both in Simien (1952) and in southern Ethiopia (1948), have been examined by Dr. G. D. Morison. His recent report (February 1958) includes also the thrips obtained during the British Museum (Natural History) Expedition to South-West Arabia (1937–38).

As Dr. Morison remarks, knowledge of the distribution of most species of Thysanoptera is very meagre. But the following points regarding geographical and altitudinal distribution may be provisionally noted:—

(i) The whole material comprises six species from Ethiopia and seven from South-West Arabia, but no species is present in both collections, though several genera are represented by distinct species in the two.

(ii) Among the six species from Ethiopia (representing as many genera), only one is identical with a species collected in 1926, namedly *Liothrips nigripes*; the remaining forms, 17 in all, collected by myself and Professor Omer-Cooper are all different.

(iii) Two species from Ethiopia are described by Dr. Morison as new, representing respectively the genera *Elaphrothrips* and *Macrophthalmothrips*; a third (*Chiraplothrips* sp.) may also be new.

(iv) Three species were taken at the highest point reached, over 14,000 feet on Degien, 11.xii.1952; though there is little to indicate which species are high-mountain forms, one of these three, *Taeniothrips meruensis*, first discovered on Mt. Meru, may prove to be a truly montane form.

Other groups of insects may be the subject of faunistic reports later; but in some cases the species must await determination when particular genera are being revised. Hitherto unworked groups include:—(*a*) LEPIDOPTERA, HETEROCERA: Several interesting new species will shortly be published by D. S. Fletcher in *The Entomologist*; (*b*) HEMIPTERA: only a single species is so far named (of the family Tingidae, a very widely distributed species according to Drake, 1954, p. 658).

(V) ARACHNIDA: Professor C. F. Roewer has described (1957) a monotypic new genus of OPILIONES (*Simienatus*). His paper includes an enumeration of all Opiliones known from Ethiopia, Eritrea and Somaliland.

A large spider living in colonies is mentioned below (p. 69). Having to limit collecting, I purposely (though regretfully) omitted spiders, owing to the lack of specialists to work them out (even the considerable collection made in 1926–27 remains unworked). I would have preserved pseudoscorpions (CHERNETIDIA) had I found any. But the seven representatives of this group discovered in 1926–27 were all dwellers in forest (see below, p. 81); none came to light in the mainly bare high country of Simien.

(VI) CRUSTACEA, TERRESTRAL ISOPODA: Dr. A. Vandel has kindly

examined the woodlice collected in Simien (1952) and in the Gughé Highlands (1948). The material is too small for precise determination ; moreover, in the Porcellionidae male specimens are lacking. Yet, having considered it together with the reports of K. H. Barnard (1940, 1941) respectively on the Isopoda of the Entomological Expedition to Abyssinia (1926–27) and of the British Museum (Natural History) Expedition to South-West Arabia (1937–38), he has sent me (18.iii.1957) a most interesting typed note.

Ethiopia appears to be the meeting place of the European fauna with that of Africa south of the Sahara. The woodlice of the highlands fall into two categories : (a) *forms with North Atlantic affinities*, represented by Porcellionidae of the typical genus *Porcellio ;* and (b) *forms with Gondwanian affinities*, all belonging to Eubelidae, a family ranging from Tropical America through Tropical Africa to Indo-Malayan lands, and specially well represented in the mountains of central and eastern Africa. The Eubelidae known from Ethiopia are in fact closely related to those of the high mountains of eastern Africa.

Considering these two categories more closely :—

North Atlantic forms. In Simien several examples were taken of a *Porcellio* akin to *P. spatulatus* Barnard (1940), which latter was found (1926) in Jem-Jem Forest, west of Addis Ababa, above 8000 feet, and on the heath-land of Mt. Chillālo, about 12,000 feet. Barnard described two other species of *Porcellio*, one from Addis Ababa and Jem-Jem Forest, *c.* 8000 feet and above, the other from somewhat lower, roughly 7000 feet, at the lakes of Addas. He also described (1941) *P. yemenensis* from altitudes between 8400 and 9700 feet, thus indicating an affinity between South-West Arabia and Ethiopia, though the representatives of the genus on opposite sides of the Red Sea may be distinct. The species of *Porcellio* known from Ethiopia and the Yemen are not only the most southern members of the genus, but also differ notably from European species.

Gondwanian forms. The Eubelidae comprise a *Microcercus* from Simien (Arghine, *c.* 11,500 feet, xi.1952) possibly identical with *M. abyssinicus* Barnard (1940). Two others from the south, both from high places in the Gughé Highlands, are : *Eubelum* sp. akin to *E. ignavum* Budde-Lund (1899), from the summit of Mt. Tola, over 11,000 feet, 15.xii.1948 ; and *Gerutha* sp., possibly *G. nitida* Budde-Lund (1912), from the mountains south of Bonghé, 31.xii.1948.

Biogeographical relationships of the flora. These remarks fall under two heads : —(*a*) the views of botanists on the floristic relationships at issue, and (*b*) my own impressions after comparing (so far as I can) the flora of northern Ethiopia with that of the centre and south.

(*a*) Principally the recent writings of J. B. Gillett on ' The relationship between the highland floras of Ethiopia and East Africa ' (1955) and E. Milne-Redhead on ' Distribution-ranges of flowering plants in Tropical Africa ' (1954).[42]

Gillett indicated that the Ethiopian and East African highland floras do not, as might be expected, constitute simply two phytogeographical regions, separated by the lowland subdesert belt on either side of Lake Rudolf. On the contrary, a floristic frontier appears to divide the Ethiopian highlands into two regions, northern and southern, approximately in latitude 10° N.[43] (the dividing line may be farther south, as explained below).

According to this view, eastern and north-eastern Africa includes three phytogeographical regions of highland plants : northern Ethiopia, southern

[42] Several articles, even more recent, on montane vegetation in Africa appeared in June 1955, in *Proc. Linn. Soc. Lond.*, **165**, Part 2.

[43] This is about the latitude of Debra Marcos, provincial capital of Gojjam. So far as Gillett takes into account the lowland dry scrub and desert country, below 3000 feet, to the east, he shows the phytogeographical boundary bending north-east and touching the coast near Djibouti ; see his map, op. cit. p. 461.

Ethiopia, and eastern Africa (the last comprising the highlands of Kenya, Uganda, and possibly Tanganyika). And ' the [highland] flora of southern Ethiopia is much more like that of Kenya and Uganda than it is like that of northern Ethiopia ' (Gillett, op. cit., p. 463). Gillett tabulated percentages of species of eight families ; although the total numbers of species are small, the trend is the same in all but one group. In the Senecioneae the trend is reversed, which may be explained if speciation has occurred in this group comparatively recently, since the gap south of the Ethiopian highlands assumed its present arid state.

At present, the subdesert country of lava and sand about Lake Rudolf, forming a belt over 150 miles wide, and well below 3600 feet in altitude, would appear a formidable barrier to dispersal of plants. On the other hand, the only apparent physical gap between southern and northern Ethiopia, the Abbai (Blue Nile), though not reaching right across the highlands, does, with certain of its eastern tributaries, extend roughly east to west for nearly 200 miles (excluding its windings). But, though forming one of the greatest canyons in the world, 4000 feet deep over much of its course, it is far too narrow to have barred the dispersal of plants.

The difference between the floras of northern and southern Ethiopia may (Gillett, op. cit., p. 464) be due largely to differences in climate. The boundary may not be sharply defined, but could perhaps have been placed a little south of lat. 10° N. Among the northern plants, for instance, *Rosa abyssinica* is abundant in places near Addis Ababa, about lat. 9° N., and it occurs in the forest on Mt. Chillālo, about 7° 55′ N. (after crossing lower country from Mt. Zuquāla to Mt. Chillālo, I noted in my journal, 14 November 1926, that brambles, jasmine, clematis and wild rose ' reappeared ' in the Chillālo forest, at about 9000 feet). Frosts may be more severe in the north, but several degrees (Fahrenheit) frequently occur on the plateaux north of Addis Ababa and I experienced four degrees of frost on Mt. Chillālo, at 10,000 feet, in November (Scott, 1952, p. 114). Gillett's distinction between single and double rainy seasons is important, but in Ethiopia double rains occur only in the far south.

Will further study reveal the existence of a corresponding zoogeographical partition between northern and southern Ethiopia ? More probably several or many gradations exist in the fauna, with limits differing in different groups.

E. Milne-Redhead (1954) dealt with several categories of Tropical African flowering plants, each characterized by a distinctive type of geographical distribution. One such category, represented in northern Ethiopia, is the ' Northern Savannah ' type of distribution, of which the tree *Anogeissus leiocarpus* is a striking example. As indicated in Milne-Redhead's map (1954, p. 29), this tree occurs in an irregular belt right across Africa from west to east, from Senegal to northern Ethiopia. It is (as I saw) an important component of the forests at moderate altitudes (3000–5000 feet) in the forest-belt south of the Tacazzé River, but is unknown in the vegetation of corresponding type, the ' Southern Savannah ', in the centre and south of the country.

Milne-Redhead also instances certain highland plants widely distributed up the eastern side of Africa, extending northwards into Ethiopia, and occupying detached areas on the west side of the continent, near the coast of the Gulf of Guinea (see his figs. 13 and 14). Apparently these plants do not extend far into northern Ethiopia. For example, his mention of *Anemone thomsonii*, a ' high mountain plant with a restricted northern distribution on the East African mountains ' (op. cit., pp. 34–35, fig. 15), recalls my having found this anemone flowering on Mt. Chillālo, at nearly 10,000 feet, 19 November, 1926 ;[44] but I did not find it in northern Ethiopia.

[44] See Scott, 1952, p. 151.

(*b*) My personal impressions here concern only some aspects of the high-mountain flora :—

[*Zones recognized by the Ethiopians*. I would first amplify particulars given in my previous paper (1952, p. 94) of the zones of climate and altitude recognized by the Ethiopians themselves, as these have characteristic vegetation. The lowest is *barahā*, wilderness or desert ; then *quallā* (also transliterated *quolla*, *kwolla*), the lowlands up to nearly 6000 feet ; *waynā dagā* (literally ' highlands of the grape ', *wayīn*), from the upper limit of the *quallā* to approximately 8000 feet ; and *dagā*, the colder highlands, from about 8000 feet upwards. The coldest altitudes of all are sometimes called *wurch*, ' frost ' (*urēc* in Italian transliteration). See Beckingham & Huntingford, 1954, pp. 20, 21, footnote.]

Belts or zones of vegetation.[45] It is more difficult to recognize a series of vegetation-zones in Simien than in southern Ethiopia where, as shown (1952, pp. 91–94), the massifs exhibit a succession of zones, more or less nearly complete, like those of the East African mountains. That the series of zones in Simien is incomplete and less regular is largely due to the very different topography. The huge elevated block, divided and subdivided into lesser massifs and ranges, and bounded on north, west and east by towering precipitous escarpments, does not lend itself to regular development of vegetation-zones as do volcanic cones and other more symmetrically shaped mountains. The different climate of the north and other causes have also doubtless contributed to the existence of present conditions.

Nevertheless single species, and associations of species, of plants are characteristic of particular altitudes on the plateaux, and on the high mountains. For example, on the plateau at a little above 6000 feet, east of Enda Sellassié, stand isolated groups of wild date-palms (*Phoenix abyssinica*), each with several trunks. Though not seen elsewhere on this journey, they recalled similar palms growing at many places in central and southern Ethiopia, at altitudes between 6000 and nearly 8000 feet ; notably the dense natural grove north of Ghidolé (I mentioned and illustrated this, stating also the use of these palms in the manufacture of soft matting ; 1952, pp. 133, 156 ; pl. 21).

South of the Tacazzé, at altitudes between 3000 and 5000 feet, lie several expanses covered with thickets, usually some distance apart, of *Oxytenanthera abyssinica*, the only bamboo seen on this journey (Plate 3). Farther west, towards the Sudan frontier, it forms thick forests (Pichi-Sermolli, 1940, pp. 616–617, fig. 6). These expanses of bamboos are very different fom the dense, neatly fenced woods and groves of *Arundinaria* found at 9000 feet and higher in the Gughé Highlands. The complete absence of any bamboo at high altitudes constitutes one of the greatest differences between the vegetation of high Simien and that of the southern mountains.

The wild olive tree, *Olea chrysophylla*, as far as I saw, is only present in quantity in the southern part of the Simien massif, in rather dry country on the mountain slopes of the lower Mai Shāha valley at about 8000 feet (Plate 16), and again in bush country west of Deresghié, at about the same altitude. These trees recalled the numerous wild olive trees seen far in the south, on the lower slopes of juniper-forested hills west of Yavello, and in dry forest in Sidāmo Province, between Agheré Maryam and Fasaganat (Scott, 1952, pp. 161–162).

When truly montane vegetation is reached, there is more resemblance between Simien and the southern mountains. The huge northern escarpment, as seen

[45] In my former paper, as explained (1952, p. 91), I used the term *zone* to denote broad divisions such as *montane forest*. These are called *belts* by Olov Hedberg (1951), who employs *zone* to denote the main subdivisions of his *belts*. In other words, my *zones* correspond to Hedberg's *belts*, while Hedberg's *zones* correspond to my *subzones*, for instance, the *bamboo subzone*. These *subzones* are termed *étages* by Jeannel (*Hautes Montagnes d'Afrique*, 1950).

from the motor-road to the Wolkefit Pass (about 9900 feet), presents a fairly abrupt transition to the zone of tree-heath (*Erica arborea*), bush-*Hypericum*, *Kniphofia*, etc.

Differences in detail between the northern and southern mountains are indicated in the following examples (not intended as complete analyses of the local distribution of the genera mentioned). Mt. Chillālo may be intermediate between Simien and Gughé in the relationships of its plants, just as its situation (roughly one-third of the distance from Gughé to Simien) is intermediate :—

(i) *Montane plants of northern affinities found* (*in my experience*) *only in Simien.* Not having visited Abūna Yosef and other northern mountains relatively close to Simien (see Fig. 5), I cannot state positively that the following plants do not exist there, though this is doubtful. At any rate they do not reach the mountains of southern Ethiopia :—

(*a*) The golden-yellow *Primula*, *P. verticillata* subsp. *simensis*, is fairly common at high altitudes in narrow gorges or any situation shaded during part of the day, and consequently moist (Plate 17). The typical form was discovered by Forskål in South-West Arabia ; the nearest ally of subsp. *simensis* is subsp. *boveana*, native of Mt. Sinai.

(*b*) The succulent *Afrovivella simensis*, resembling the related house-leek (*Sempervivum*), was only found at about 12,000 feet, near the main northern escarpment ; growing on the face of an overhanging rock, providing shade and moisture.

(ii) *Some of the familiar genera of the southern mountains are represented in Simien* by species wholly or in part different. For instance :—

(*a*) In the genus *Swertia* (Gentianaceae), the large white form (near *S. kilimandscharica*) found on Mt. Damōta, and the tall form with maroon-purple flowers (provisionally determined as *S. lovenii* var.) found in the Gughé Highlands, were not seen in Simien, where, however, flourishes the beautiful blue-purple *Swertia schimperi*.

(*b*) Out of six species of *Helichrysum* collected, I had found three on my southern journey in 1948 (*H. foetidum* and *H. formosissimum* in Gughé, *H. fruticosum* var. *compactum* on Damōta) ; but *H. citrispinum*, an important floristic component in Simien, and *H. schimperi*, were not seen in Gughé (though found on Chillālo in 1926) ; the sixth Simien species, *H. glumaceum*, from the Mai Shāha valley, was new to me.

(*c*) Only one *Alchemilla* was found, an undetermined herbaceous species (at about 11,000 feet and higher, not in flower). In contrast, on Chillālo and the Gughé mountains, besides herbaceous forms, large expanses are covered with the tall, upright *A. haumannii*, a member of the woody-stemmed group of species, the centre of dispersal of which is the Ruwenzori range (Hauman & Balle, 1934, cited by Scott, 1952, pp. 149–150 and Plate 18).

(iii) *The genus Senecio.* No truly arborescent forms (i.e. with a single trunk) like those of the Central and East African mountains are known from Ethiopia. But of several bush-Senecios I saw two, five to six feet high, in Simien at altitudes from 9900 to over 11,000 feet : *Senecio myriocephalus*, previously found in the Gughé Highlands, and *S. confertus*. These were growing separately (not mixed), in patches from eight to thirteen miles apart. A herbaceous species, *S. farinaceus*, two to three feet high, covered a piece of ground at my highest point, above 14,000 feet (below the Pass of Degien, 11.xii.1952). Yet another species, a low tufted form growing out of a vertical rock-face at more than 14,000 feet on Buahit, remains undetermined.

(iv) *The giant lobelias.* A section below (p. 71) is devoted to *Lobelia rhynchopetalum* and its associated animals. Here it need only be said that both the species occurring in Ethiopia are found in Simien. *L. rhynchopetalum* is abundant at about 11,000 feet and upwards (Plates 11, 13, 15). This endemic species is widely but discontinuously distributed in Ethiopia at such altitudes, its range including the Abūna Yosef massif (Raffray, 1885, p. 300), the Choké Mts., Chillālo, Gughé and other high massifs ; but it is probably on the whole more plentiful on the northern than on the southern mountains.

L. giberroa, on the other hand, though widely distributed in eastern Africa as

well as Ethiopia, usually occurs below 10,000 feet and, in the south, is frequently preserved near houses when other wild vegetation is cleared. It seemed local, if not scarce, in Simien, where I saw only one plant, near the Wolkefit Pass, and have not heard of it except in that part of the massif. It appears to be the opposite of *L. rhynchopetalum*, i.e. a southern species, extending into northern Ethiopia but less abundant there (see postscript, p. 91).

Nowhere on this northern journey was any counterpart seen of the small, delicate lobelias with bright, light blue flowers, several forms of which are common in grassland in the south, between about 6000 and nearly 9000 feet (1952, pp. 126, 148).

(v) *Two coniferous trees.* The undulating plateaux of Simien were probably once largely covered with forests of giant juniper (*Juniperus procera*; Amharic, *tid*), now almost entirely destroyed. Many tall and large junipers remain in the precincts of churches. At Shaha Ghiyorghis I roughly calculated the trees surrounding the church to be at least 50 to 60 feet high (Plate 17), while some of those in the grove at Derasghié may be much taller. Moreover, about Shaha Ghiyorghis a broad expanse of country is dotted with secondary growth of juniper, individual trees and thickets no higher than tall bushes, mixed with other bushes and herbaceous plants (see background of upper photograph, in Plate 7). Shaha Ghiyorghis and Derasghié both lie somewhat below 10,000 feet. The regrettable deforestation could be partly made good by re-planting at about 9000 to 10,000 feet. Probably forest never extended to the highest parts of the upward-sloping plateau, close to the edge of the northern escarpment, and above the tree-limit.

No trace was seen of the other conifer, the *zigba* (*Podocarpus gracilior*), nor have I read of it in northern districts. Though in some forests *Podocarpus* and *Juniperus* are mixed (for instance, in parts of Jem-Jem Forest, west of Addis Ababa), on the whole *Podocarpus* luxuriates more in the south of Ethiopia and at rather lesser altitudes (compare Logan, 1946, pp. 29–35 and Table VI).

Biogeographical relationships of fauna and flora compared. Consideration of the animals and plants inhabiting high Simien necessitates some consideration of those of high Ethiopia as a whole.

In the foregoing review of certain groups of animals, mainly insects, I have emphasized the contrast between northern (i.e. Palaearctic, particularly Mediterranean) components and African (Tropical and/or South African) components, also noting in a few cases forms common to Ethiopia and the Oriental Region.

But in partially reviewing the plants, attention is focused mainly on the phytogeographical regions composing the montane flora of eastern Africa. Differences between northern and southern Ethiopia are exemplified from my experiences as a collector of plants. That animals and plants have been viewed from different angles has resulted from the information available in the two cases being different.

It is impossible as yet to make a complete biogeographical comparison betweeen fauna and flora. A fair amount of endemism is seen to exist in the fauna. But, as far as can be discerned, zoogeographical limits probably correspond closely with the phytogeographical regions only in the case of animals with limited powers of dispersal, especially insects associated with particular plants.

The range of montane animals must depend largely on their powers of dispersal. Among butterflies, for instance, the migratory, world-wide Painted Lady (*Vanessa cardui*) appears almost ubiquitous in the Ethiopian highlands while (as already stated) African forms of the Clouded Yellow, Small Copper and Bath White (*Colias electo*, *Lycaena phlaeas pseudophlaeas* and *Pontia daplidice aethiops*) range widely over the high plateaux (see above, p. 23).

On the other hand, animals with limited powers of dispersal, such as flightless insects, naturally tend (with certain exceptions) to be restricted; especially insects closely (even if not exclusively) associated with particular plants. For

instance, the apterous Sphaerocerid fly (p. 24) discovered only in decaying stems of *Lobelia rhynchopetalum* is almost certainly endemic to high Simien, or at any rate to the northern mountains, while a distinct representative of the genus was previously discovered in Gughé.

It is among these flightless insects closely associated with particular plants that a difference between the northern and southern montane faunas may be revealed. While many insects were found in Simien associated with *Lobelia rhynchopetalum*, several Coleoptera previously enumerated (Scott, 1935) as associated with giant lobelias in southern Ethiopia and East Africa are absent from the Simien list. Even certain Coleoptera discovered on *Lobelia rhynchopetalum* on Mt. Chillālo (1926) were not found associated with the same giant lobelia in Simien (1952). How far does this difference between the lobelicolous insects found in Simien and those found in the south indicate the existence of separate zoogeographical subregions? Or how far is it due to fluctuations in abundance of particular species in different years?

Lack of certain components in the montane fauna, etc. In Ethiopia many groups of highland animals and highland plants are richly represented, including in a number of cases endemic genera and species. Other groups, which might have been expected to be well represented, are poorly represented or entirely wanting. Instances of this comparative poverty of the montane fauna and flora of Ethiopia, as compared with those of eastern and central Africa, were given in my former paper (1952, pp. 89–91), where some possible explanations were suggested; among them, the fuller development of the highest zones of vegetation, due to the greater heights of the East African mountains, and/or possible destruction of parts of the ancient fauna and flora in Ethiopia. Whatever be the gaps, the admixture of northern and oriental with characteristically African elements renders the fauna and flora specially interesting.

The views expressed in the following paragraphs are based on the evidence as I see it, and on the published opinions of experts.

(i) So far as concerns terrestrial animals, it seems doubtful if any satisfactory explanation is yet forthcoming. For example, Moreau remarked (1954) on the comparative fewness of passerine birds in the evergreen montane forests of Ethiopia, though these forests would appear a promising centre of evolution.

There is no apparent reason why destructive agencies such as volcanic activity and glaciation should have been any more powerful in Ethiopia than in other parts of the highlands of eastern Africa. Were these agencies (it has been asked) anywhere extensive or continuous enough to cause wholesale extinction of animals and plants?

As to glaciation, an example of the limitation of its effects on the development of an insect-fauna is drawn from a very different region, the Hawaiian Islands (below, p. 35).

(ii) Had the highlands of Ethiopia been subjected to a cold *dry* climate—to the conditions of a ' cold desert '—at any time, e.g. during the phases when the rest of the East African highlands had ' pluvial ' climates, this might have caused large-scale reduction, or even extinction, of some groups. But the theory of cold dry climates, though advanced over 40 years ago, does not appear to be generally accepted (' According to Hume and Craig (1911) it is probable that, owing to a shifting of winds, the mountains of Abyssinia were desiccated in the glacial periods. It is therefore possible that the highland fauna consists of relatively recent immigrants or of newly evolved species '; Hutchinson, 1933, p. 463).

(iii) In the case of aquatic organisms, the explanation suggested by Omer-Cooper (1930), that falls of volcanic dust may have exterminated some aquatic animals from the lakes of the Galla Depression, has not been held adequate to explain the phenomena as a whole.

According to Worthington (1954), while the present boundaries of aquatic regions in Africa are generally obvious geographical features such as watersheds, the reasons for regional differences lie not so much in existing features as in past geological history.

In his suggested definition of aquatic regions (op. cit., pp. 69–70), the lakes and rivers of Ethiopia fall under two heads : (*a*) his second, or *Nilotic* region, of which Lake Tana is a subregion, largely isolated by the falls and rapids of the Blue Nile, while Lake Rudolf is another subregion, isolated and now without outflow, but formerly draining northwards into the White Nile via the Sobat River ;[46] and (*b*) his seventh region, that of the *Eastern Rivers*, including the Hawash and also comprising a number of closed drainage basins. The fauna and flora of the Eastern Rivers are mainly tropical in affinities, but poorer in genera and species than those of the Nilotic, Congoan or Western Rivers aquatic regions.

(Lake Rukwa, in Tanganyika Territory, north-west of the northern end of Lake Nyasa, is considered the most important closed drainage basin of the Eastern Rivers aquatic region. The lakes of the Galla Depression, which I circumambulated in 1948–49 from Lake Zwai southwards to Lake Chamo, are also all closed inland drainage basins (Scott, 1952, p. 110 and map). But these presumably belong to Worthington's Nilotic aquatic region, since they lie in that part of the Rift-Valley System sloping south-westwards to the north-eastern shores of Lake Rudolf).

According to his exposition, changes over immensely long periods included erosion of the African land-mass to a peneplain ; subseqent tectonic movements producing depressions and altering the courses of rivers ; followed by a long period of volcanic activity, and later by the climatic alternations known as Pluvials and Inter-pluvials. Some of the results of these processes have been : formation of closed inland drainage basins ; multiplication of ecological environments, with consequent evolution of distinct species through isolation ; and reduction (or perhaps, in some cases, obliteration) of the aquatic fauna of rivers and lakes by partial or complete desiccation during Inter-pluvial phases.

The explanation briefly abstracted above covers Africa as a whole, but does not refer particularly to the highlands of Ethiopia. Yet the exceptionally high average altitude of those highlands must be remembered. The ' Abyssinian block ' was elevated to a mean altitude above 8000 feet, higher than any other block of corresponding size in the surface of Africa. This process of elevation is ascribed to times since the Miocene (estimated to have ended some 12,000,000 years ago). The formation of the Rift-Valley System must also have had a profound effect in this northern area, as it did farther south.

[*Effect of glaciation on the insect-fauna of the Hawaiian Islands.* The zoogeographical and phytogeographical regions to which Ethiopia and the Hawaiian Islands belong could scarcely be farther apart. Moreover the Hawaiian Islands are physically isolated by broad stretches of ocean, while the highest mountain massifs of Ethiopia are at the most relatively isolated by intervening expanses of lower and drier plateaux. Nevertheless the following comparison strongly supports the conclusion that glaciation in itself may not greatly influence the development of a fauna (see Zimmerman, 1948, sections on ' glaciation ' and its ' influence on the biota ', pp. 31–35).

The island of Hawaii, approximately in lat. 20° N. and long. 155° E., presents the only evidence of glaciation on any island in the Pacific. In this largest of the Hawaiian islands, the great volcano Mauna Kea (13,784 feet, the maximum height in the archipelago) displays unmistakable traces of an ice-cap some 20 miles square,

[46] The gap between the Imatong mountains and the south-west part of the Ethiopian highlands is now low and dry ; the change from its former to its present condition must surely have had important biogeographical effects (Moreau, 1952, p. 875).

extending down to about 10,500 feet, and possibly several hundred feet thick. As the whole mountain top is of late Pleistocene or recent formation, the glaciers existed in the latest glacial phase, rather over 25,000 years ago. Even to-day, though there is no permanent snow, frosts are frequent and snow occasionally lies in patches throughout the year.

Yet the insect fauna, with its very high proportion of endemic species, shows no important features directly attributable to climatic change within the islands. There is no sign of large-scale extermination of species having taken place through cold. Such effect as glaciation produced was more probably indirect, through increase in rainfall. Even to-day thousands of dead insects can be seen, frozen to death on the barren, arid mountain tops, whither they have been blown by winds. But it is doubtful if species have been exterminated thus, for many range upwards through thousands of feet, so that 'tropical' forms of the middle altitudes also inhabit heights where frost and snow occur.

Though in Ethiopia the summits were glaciated in at least two phases and, in the earlier period at any rate, the glaciation was much more extensive than in Hawaii, it may be doubted whether the development of the fauna was much influenced thereby.]

Part 3. Previous Exploration

The work of earlier traveller-naturalists is viewed from a historical standpoint, irrespective of subsequent changes in scientific methods or in conditions of travel. For the experiences of earlier travellers have a bearing on contemporary explorations; while, away from modern motor-roads, trekking over the mountain tracks is much as it has been for generations.

It is unnecessary to discuss fully the early *topographical* exploration of Simien because, though these highlands are still incompletely surveyed, their scenery and general topography have been much more fully described than had those of the Gughé Highlands, before my visit to the latter in 1948. Pichi-Sermolli, in a geographical article (1940, p. 25), gave a valuable bibliography of early exploration. Most of the titles need not be repeated; but the outstanding importance of the work accomplished by the geographer Antoine D'Abbadie in the years 1838 to 1847, emphasized by Pichi-Sermolli, should be noted (see Appendix 1, pp. 76–7).

Some general works not included in Pichi-Sermolli's bibliography are mentioned in this paper, such as those of James Bruce (1790) and Henry Salt (1814). Also that of Sophie F. F. Veitch (1868), reproducing the drawings of a German traveller not named at the time of publication, as he was believed to be one of the captives of the Negus Theodore at Magdala. These drawings include scenes in Simien and its most striking plants; some were reproduced by Jeannel in *Hautes Montagnes d'Afrique* (1950, chap. 10; see postscript, p. 91).

The Guida Dell' Africa Orientale Italiana (1938), which I constantly used on this as on my previous journey, is referred to in the following pages simply as *Guida*.

Col. H. E. Hebbert kindly lent me the unpublished general account of his remarkable journey made with Mrs. Hebbert early in 1943. Starting from Khartoum, they travelled over much of the Ethiopian highlands by car, also partly by mule-caravan. After going south by car from Asmara to Gondar, they trekked northwards to high Simien, via Derasghié to the top of Buahit (perforce omitting Ras Degien). The only information published was the finding of snow, as distinct from hail, in a note by R. E. Cheesman (1950); details, amplified by Col. Hebbert, are recorded below (p. 45).

Sportsmen and Zoologists. The narrative of Powell-Cotton, *A sporting trip through Abyssinia* (1902) deserves special mention for its chapters on Simien.

Maydon's *Simen,*[47] *its heights and abysses* (1925), which I re-read during my

[47] Maydon used the two-syllable form of the name (see Appendix 3, p. 79).

journey, is the record of two travellers (H. C. Maydon and G. Blaine) who visited the district, mainly as sportsmen, in 1922–23. But the walia ibex[48] has attracted other travellers to Simien for more scientific exploration of its natural history. Such were the members of the expedition from the Chicago Museum led by Dr. W. H. Osgood, three of whom visited Simien between 23 February and 14 April 1927; besides ibexes they collected other mammals, as well as many birds (Fuertes & Osgood, 1936; Osgood, 1928; Baum, 1928; Bailey, 1932).

Entomological exploration. No intensive investigation of the insect-fauna of Simien had previously been attempted. Accounts of insects obtained by some general expeditions to Ethiopia in the first half of the 19th century contain no special reference to the Simien highlands. For instance, the province of 'Samen' (Simien) is named in the full title of the 'Voyage en Abyssinie' of Ferret & Galinier (1847). Some new insects were described in the enumeration by Marchal, Reiche & Spinola, published later with an 'Atlas' of figures; but, as this work included no records of localities, it is difficult to say which species (if any) were discovered in Simien. The editions (1846 and 1851) of Lefèbvre's *Voyage*, undertaken at about the same time (1839–43), also comprise a volume devoted to zoology, including insects, but not dealing specially with Simien.[49]

Entomological work of Raffray in Ethiopia; an early delimitation of altitude-zones. Achille Raffray, an entomologist of high standing as collector, systematist and draughtsman, spent some years in Ethiopia, undertaking two long journeys, besides numerous shorter excursions. Though prevented from doing more than view the summits of Simien from a distance, he worked in very similar country among those of the Abūna Yosef massif to the south-east.

Raffray's delightful book *Abyssinie* (1875; 2nd ed. 1880), describing his first long journey in 1873–74, is a general description of Abyssinia and narrative of his adventures, with short sections devoted to entomology. This scientific mission lasting eight months was made in company with the French vice-consul at Massawa (Comte E. de Sarzec), who was officially visiting the Negus Yohannes.[50]

Raffray's narrative shows how close he was to the peaks of Simien. In returning north from Gondar, the two travellers crossed the Woghera plateau, near the edge of the western escarpment of Simien, by a track coinciding nearly with the present motor-road. But no chance to search for specimens! For, though on an official mission under the protection of the Negus, they were treacherously attacked, and might easily have been killed, by the inhabitants at a village[51] north of Gondar. After a fight in which the Frenchmen had to use their firearms in self-defence, they and their servants barricaded themselves in a church, where they remained three nights and nearly three days. Eventually, after long negotiations by local chiefs, they were allowed to depart, and hurried northwards with their baggage and Raffray's collections.

This episode indicates the risks then attending exploration. Raffray suspected that the attack was due to the resentment aroused in the Coptic clergy

[48] These magnificent animals, said to be now confined to the almost inaccessible outlying ranges, must be in sore need of protection if the species is to survive. I saw none.

[49] Several members of this disastrous mission died from accident or fever. Lefèbvre alone returned to France, to succumb soon after to an illness contracted during the journey.

[50] Raffray later succeeded de Sarzec as vice-consul at Massawa for several years, during which he undertook a six-months' journey 'from the frontiers of Nubia to the Galla country'. Apparently he published no full account of this journey, to which, however, he alluded in discussing the geographical distribution of Coleoptera in Abyssinia (1885, p. 294).

[51] See Raffray's *Abyssinie*, chap. 7, pp. 320 *seqq.*: he wrote the name of the village Ouébéin-Mariam. I have not seen it on any map besides that at the end of his book, but I must have passed close to the village without knowing.

by the promise of the Negus, on the vice-consul's request, to grant more tolerant treatment to Roman Catholic missionaries. (In 1952 a police escort was needed during much of my journey, but simply for protection against brigands.)

Raffray was probably the first entomologist to delimit altitude-zones in Ethiopia, as described in his ' Note sur la dispersion géographique des Coléoptères en Abyssinie ' (1885). His method, based simply on carefully noting the altitude, climate and environment in which particular insects were found, would seem primitive in countries where records are regularly published by meteorological stations, but it may still be the only practicable method in remote districts of Ethiopia.

He remarked how the four entomological zones so determined coincide with distinct types of country and with different plant-associations. I was not concerned with his lowest, or ' littoral ' zone, where largely desert conditions prevail, and scarcely at all with the second, or ' region of valleys and lower plateaux ' (approximately from about 3300 to 6500 feet). But his third, the ' high plateaux, or Ethiopian zone ' (using ' Ethiopian ' in a zoogeographical sense), comprises the very large part of the Abyssinian highlands between 6500 and about 8200 feet ; grassy slopes, arable land, marshes in places, almost countless streams usually fringed with trees ; otherwise trees are scarce in many districts, though flat-topped acacias grow in valleys, also wild olives in places, and coniferous forest where it has not been felled. Raffray found this zone entomologically very rich (as I did) and noted the admixture of Mediterranean and African forms. He thought that this third zone had the highest proportion of endemic species, but in the light of later investigation this more probably applies to his fourth and highest, or (as he termed it) ' subalpine zone '.

Raffray's only personal experience of the highest zone was on the Abūna Yosef massif (or ' summits of Lasta ', as he wrote, using the district-name). Of these he gave (1885, pp. 299–301) a brief but vivid description, from Abbi Miedà on the east to Abūna Yosef on the west ; these two points being united by a crest at a mean altitude above 12,000 feet, culminating in the roughly 13,700 feet of Abūna Yosef itself : little mossy plateaux and marshy places, whence arise innumerable streams, uniting farther down to form the Taccazé ; clumps of *Helichrysum* in drier spots, with tree-heath hung with lichens and, growing at the highest altitude of all, *Lobelia rhynchopetalum*. This strongly recalls parts of high Simien.

Classing the high summits of Simien provisionally in his subalpine zone, Raffray asked whether, on account of their greater height, the ' alpine ' element in the fauna would prove even more accentuated than on other Ethiopian mountains, adding : *j'espère qu'un jour des entomologistes plus heureux que moi pourront résoudre la question* (1885, p. 299). I have tried partially to answer his question in Part 2 of this paper.

Another eminent French entomologist and traveller, Charles Alluaud (1861–1949), had prepared for an expedition to Ethiopia in 1914 but was prevented by the First World War. So he never visited Ethiopia, though his exploratory missions, undertaken for the Muséum National d'Histoire Naturelle, included journeys to Mts. Kilimanjaro and Kenya, and to the Ruwenzori range (see Jeannel, 1952). Alluaud's writings on the montane faunas of eastern Africa include some on the Carabid Coleoptera of Ethiopia.

Early collectors of Mollusca. Dr. L. Forcart has referred (1957) to material collected in 1871 by Jickeli. Two narratives appeared, respectively by Jickeli (1874) and another traveller, Munzinger (1872). Jickeli, entering the country at Massawa, wished to go south into Abyssinia proper but, as political conditions prevented this, his itinerary lay mainly in territory now included in Eritrea. Later he accompanied Munzinger north from Asmara to the country of the Beni Amer and Habab tribes, visiting the Enjelal Plateau (about 16° 30′ N.), rather below 8000

feet, and the Rora Plateau farther north. He recorded that, between Massawa and Asmara, altitudes from about 5500 to 7000 feet (the much cultivated zone called *waynā dagā*) were the district richest in Mollusca. As he did not reach the high mountains, he could not investigate the montane Mollusca which, though comparatively scarce on the peat-lands, may be specially interesting.

Geological and botanical exploration, etc. The valuable research, notably on ancient changes of climate and glaciation, carried out in Simien by Dr. E. NILSSON during an expedition to East Africa and Ethiopia in 1932–33, and published in 1940, is cited above (pp. 7–14); also that of E. MINUCCI, geologist of the Italian mission to Lake Tana. The geological work of GRABHAM & BLACK (1925) concerned Lake Tana and the surrounding country, but not Simien; while that of W. H. BLANFORD (1870) dealt with the country east and south-east of Simien, traversed by the military expedition to Magdala in 1868.

Seven volumes of results of the Italian MISSIONE DI STUDIO AL LAGO TANA have so far appeared (1938–51). Its members, who visited the region during the first four months of 1937, were principally occupied with the lake itself and its basin. But two of them, Professor PICHI-SERMOLLI, botanist, and E. MINUCCI, geologist, went farther afield, travelling through high Simien for 13 days in April.

Botanically, Simien had previously been explored in the 19th century by the German collector W. G. SCHIMPER. Sent to collect plants in Ethiopia in 1837, he resided in the country almost continuously till his death in 1878: The periods when he visited Simien were part of 1840, 1850 and 1852.[52] But Prof. PICHI SERMOLLI explored these high massifs afresh in 1937, as recounted in his general articles (1938, 1939), while vol. 7 (1951) of the MISSIONE DI STUDIO is devoted to the first part of his systematic account of the flowering plants of the Lake Tana basin and of Simien, as well as lower districts to the west.

The above are not the only botanists who have visited Simien. Other collectors went there between the time of Schimper's last visit and that of Prof. Pichi Sermolli. One, VON HEUGLIN, cited below in my narrative (p. 52), illustrated his account with good coloured lithographs, particularly a fine plate showing *Lobelia rhynchopetalum* (1868, opposite p. 186).

No zoologist of the Italian mission to Lake Tana visited Simien, but notes by Dr. G. BINI on vertebrate animals collected in the basin of the lake were published in vol. 1 (1938, 105–122); and vol. 4 (1940) by E. MOLTONI is devoted to ornithology of the region.

No scientific expedition, as far as I am aware, visited Simien after 1937 until my trek in 1952. My visit was closely followed by that of J. WERDECKER during his journey in Ethiopia in 1953–54; his important geographical contribution (1955) is mentioned in Appendix 1 (p. 76).

SUMMARY OF PARTS 1, 2 AND 3

(1) An attempt is made to treat high Simien *as an entity*, and to relate the existing montane fauna and flora with their specialized environment.

(2) The strange topography and geological structure of the districts of SIMIEN and TSELLEMTI are outlined. Like other massifs rising above the high plateaux in Ethiopia, these highlands are not merely a northward extension of those of eastern Africa, but display peculiar geographical features. Their northerly situation and relative isolation are emphasized and their distances from other massifs are given. Though Simien includes the highest points in Ethiopia

[52] See the biography, with list of Schimper's collecting-places and bibliography, published by G. CUFODONTIS in 1951 (see postscript, p. 91).

(greatest altitude just over 15,000 feet ; no perpetual snow), these are considerably lower than the highest East African mountains ; yet much of the surrounding plateau is exceptionally high.

(3) Surveys (little noticed in British journals) of volcanic formations, and of traces of former glaciation, in Ethiopia as a whole but with special reference to Simien, are summarized. But the effects of these agencies on the development of the fauna and flora were probably restricted in extent. The limited effect of glaciation on the development of the fauna in the remote Hawaiian Islands is mentioned in support of this view.

(4) From a zoogeographical standpoint, a few cases (well known to specialists) are given of the mingling of northern and tropical African mammals and birds. The *interim* conclusions regarding invertebrate groups are based on reports by specialists concerning the parts of the collection (mainly insects) hitherto worked out.

(5) Though it is difficult to make a general statement covering all groups, the predominant relationship is apparently African, even among forms inhabiting high altitudes. But there is a marked admixture of Mediterranean and other northern components in certain groups. The northern elements are in some cases stronger than in central and southern Ethiopia, as might be expected from the northerly situation and greater height of the Simien massifs. (Dr. Vandel's remarks on the Isopoda are specially interesting. As far as woodlice are concerned, not merely Simien but the highlands of Ethiopia as a whole appear to be the meeting-place of forms with, respectively, North Atlantic and Gondwanian affinities ; see above, p. 29.)

(6) The facts and the consensus of specialist opinion point to many of the endemic forms on different massifs having evolved from ancestral stocks inhabiting adjacent lower country, rather than from northern ancestors having reached the African mountains by traversing wide lower expanses. For instance, descent from local ancestral forms probably explains the occurrence of three congeneric flightless Diptera (Sphaeroceridae) respectively on the Aberdare Range (Kenya), the Gughé Highlands and Simien, separated by two gaps of some 500 miles apiece. Other examples of local endemism are given immediately below under 7 and 8.

(7) Noteworthy examples of endemic descendants of northern stocks are seen in the Carabid genera *Trechus s. str.* and *Calathus*. But whereas in eastern Africa species of *Trechus s. str.* occur on the mountains as far south as Kilimanjaro, representatives of *Calathus* extend no farther south than Ethiopia.

(8) Nearly all the species of *Trechus s. str.* and *Calathus* hitherto recorded from Ethiopia have been found only on one massif.

The seven new species of *Trechus s. str.* discovered in Simien are so far unknown from other massifs ; of the eight previously known Ethiopian species, seven are recorded from only one massif (two from Mt. Abūna Yosef, four from Mt. Chillālo, one from the Gughé Highlands), but the eighth species, discovered at a lower altitude, 7200 feet, may be more widely distributed.

Three species of *Calathus* discovered in Simien, also new to science, are unknown elsewhere ; those previously found respectively on Chillālo and the Gughé Highlands appear also to be confined to their massifs. But other Ethiopian *Calathus*, occurring at somewhat lesser altitudes, are more widely distributed though still apparently confined to Ethiopia.

Other arthropods discovered in high Simien include two monotypic new genera of, respectively, Diplura (Japygidae) and Opiliones.

(9) *Flightlessness, ' regressive evolution'*. All the 15 species of *Trechus s. str.* recorded from high Ethiopia are apterous ; and all the 17 species of *Calathus*, so far as it has been possible to examine specimens, are apterous. Flightlessness is not universal in either genus. But other flightless *Trechus* (e.g. some European

species) are known. In *Calathus* many European species are fully winged, others have the wings reduced, while many mountain-dwelling forms in the Alps and Pyrenees are wingless.

Coleoptera showing reduction or loss of eyes and pigment were not found in Simien. Anillini may be found there later, at rather lower altitudes, in forest. The totally blind Pterostichine genus *Caecocaelus*, represented by several species in southern Ethiopia and the mountains of the eastern Belgian Congo, seems less likely to occur in northern Ethiopia.

Atrophy of the wings is also exemplified by the Sphaeroceridae, without wings or halteres, mentioned on p. 24.

(10) On the other hand, the Acridoidea (of high Ethiopia as a whole) exemplify the existence of distinct categories of highland and lowland species, without restriction of the highland species to single massifs. Thus, some brachypterous grasshoppers, formerly thought to be so restricted, occur on two or more massifs, far apart. That the altitude-range of these insects ceases below 11,000 feet may be connected with their divergence of form having gone no further. (This group also includes some species occurring at both ' lowland ' and ' highland ' altitudes, i.e. ranging through 5000 feet or more of altitude.)

(11) In Coleoptera, *no representatives of certain groups were found*, while some others were relatively scarce. The altitude was probably too great for Pselaphidae. Flower-haunting beetles were relatively scarce, possibly owing to (on the whole) dry weather and cold nights ; but the absence of some previously found abundantly on high mountains in southern Ethiopia and eastern Africa may indicate a real limit to their northward extension.

(12) Few special links with the *highlands of South-West Arabia* are apparent. But in the Carabid genus *Afrotarus* distinct species are known from the Yemen highlands (one), high Ethiopia (one) and Kilimanjaro (two). Among butterflies, naturally wide-ranging insects, some characteristic highland forms are common to South-West Arabia and Ethiopia. But distinct races of one widespread northern species have been found in the two sets of highlands, while in the genus *Pararge* divergence of highland forms has apparently resulted in distinct species occurring in the South-West Arabian and North-East African highlands (the butterflies of Arabia and Ethiopia *as a whole*, including lowland and highland species, probably have much more in common ; see Gabriel, 1954, p. 351).

(13) Instances of *melanism* in animals occurring at great heights are a Vitrinid snail (see p. 17) and a Chloropid fly (see p. 25). A *butterfly migration* was noted (p. 24).

(14) The Chloropid fly just mentioned (*Thaumatomyia secunda*) was *congregated in immense numbers* at several points between 10,000 and 14,000 feet, sheltering in vegetation, almost exclusively in the huge inflorescences of *Lobelia rhynchopetalum*. Among nearly 600 specimens taken at one place, females outnumbered males by about 2·5 to 1. This Chloropid is congeneric with *Thaumatomyia notata*, one of the most usual components of indoor autumnal swarms of small Diptera in Britain. The swarming of the African species in the open supports the evidence that the British species swarms out of doors, then enters buildings for shelter.

(15) The *relationships of the montane flora* are briefly considered. The specialist view that the Ethiopian highlands comprise *two phytogeographical regions*, of which the southern has less in common with the northern than with the montane flora of eastern Africa, is emphasized.

(16) Owing to the peculiar topography, it is less easy to recognize a succession of *zones of vegetation* in Simien than on more regularly formed volcanic massifs farther south. Nevertheless some plants were seen, characteristic of zones corresponding to those in the south of Ethiopia.

(17) In instancing differences between the plants of the highest altitudes in northern and southern Ethiopia, some species of northern affinities found in Simien but not in southern Ethiopia are mentioned.

(18) A comparison of *relationships of the montane animals and plants* indicates that zoogeographical limits do not necessarily coincide with phytogeographical boundaries. For example, insects closely associated with particular plants are likely to have the same distribution as those plants. Moreover, insects with limited powers of dispersal, owing to reduction or atrophy of the wings or other causes, are naturally less widely spread than strongly flying insects. Some of the typically highland butterflies extend over almost the whole highlands, north and south, in every district where their food-plants are present.

(19) Comparing the montane fauna of Ethiopia with that of eastern Africa, certain components of the latter fauna are *poorly represented or apparently entirely wanting* in Ethiopia. While no satisfactory explanation may yet be forthcoming regarding terrestrial animals, the lack of certain freshwater organisms may probably be explained by the geological history.

(20) In Part 3 (' Previous Exploration ') the early geographical explorations of Simien are touched on slightly, but later work, biological and geological, is more fully treated. With a frankly historical approach, the achievements of earlier traveller-naturalists are outlined, irrespective of subsequent changes in scientific methods or conditions of travel. *Raffray's division, as long ago as* 1885, *of Ethiopia into zones of altitude, based on the distribution of Coleoptera*, is noteworthy.

B. WEATHER NOTES

No meteorological station exists in high Simien, nor do I know of any records kept over a long period in those mountains. But before describing the weather met with, published data concerning the climate of Asmara, about 150 miles to the north, may be summarized (compare ' Weather Notes ' in my previous paper, 1952, pp. 110–115).

Asmara, at about 7600 feet, is situated on a rather narrow northward extension of the highlands. Relatively low steppe or desert country lies not far to the west, towards the frontier of the Sudan, while to the east the Red Sea is less than 40 miles distant at its nearest point. Yet, despite its northern position and the proximity of deserts and sea, the capital of Eritrea enjoys a climate typical of most of the high plateaux of Ethiopia.

Temperature. The mean annual, 16·7° C. (62° F.), is very little higher than that of Addis Ababa. Asmara's two hottest months, May and June, both have a mean temperature of 18·8° C. (nearly 66° F.). The coldest month is almost always November, with a mean of 14·2° C. (just over 57° F.).

According to these data[53] the monthly mean temperatures throughout the year, if plotted graphically, would need a two-humped curve, for, with the onset of the Great Rains, the mean temperature decreases from the heats of May and June to 16·7° C. (62° F.) in July and August, followed by a slight rise to 17° C. (a fraction over 62° F.) in September, after which the mean declines to the low level of November.

The wide gap between day and night temperatures is what, above all, renders caution necessary for foreign residents in this agreeable city. For instance, in October (the month which I passed there) the average maximum and minimum are respectively 21·5° C. and 10·3° C. (about 70° and 50° F.). Late in October 1952 a British resident told me that the nights had been extra cold, the maximum and minimum temperatures farther apart than for many years past at that season.

[53] Temperature data for Asmara and Gondar are from *Guida*, respectively pp. 200–201 and p. 352.

[GONDAR, at about the same altitude as Asmara, lies about 211 miles (340 km.) south-south-west, just north of the basin of Lake Tana. Though on a hillside, it is enclosed by other hills. Its monthly average temperatures and mean annual temperature are higher, the latter being 19° C. (66° F.). In January 1953 the weather seemed very hot after the climate of Simien.]

Rainfall at Asmara. The mean annual is 491·7 mm. (approximately $19\frac{2}{3}$ inches). The monthly averages vary from 0 in December and January to just over 173 mm. (nearly 7 inches) in July, and about 155 mm. ($6\frac{1}{8}$ inches) in August.

As with temperature, a slightly two-humped curve would be needed to plot the monthly average rainfall graphically; for after a rise from 0 in January to 47·2 mm. (over $1\frac{4}{5}$ inch) in May, the average falls to 27·8 mm. (about $1\frac{1}{10}$ inch) in June, before the steep rise to the maximum in July.

THE HIGH MOUNTAINS: on the other hand, the rainfall map in my previous paper (1952, pp. 111[54]) shows that high Simien lies in a zone where the mean annual rainfall is from 1000 to 1200 mm. (40 to 48 inches), while locally, and in particular years, the total precipitation may be considerably greater, especially among the highest peaks.

According to the same map, the Gughé Highlands lie in an area receiving an annual average of 800–1000 mm. (32–40 inches), though the mountains themselves almost certainly get far more rain (Scott, 1952, pp. 112, 114).

Climatic differences between Simien and Gughé. In the absence of statistics, no comparison is possible between the total annual rainfall of Simien and that of the Gughé Highlands. The two are situated respectively in about lat. 13° 20′ N. and 6° 10′ N., nearly 500 miles apart. But there is an important difference in distribution of rainfall in the two massifs. In Gughé rain is expected, on and off, during most of the year, while frost is apparently uncommon. But Simien has normally the two seasons characteristic of the highlands of Ethiopia, the Rains (*Karamt*) and the Dry Season (*Bagā*), though outbursts of bad weather, with thunderstorms accompanied by hail and occasionally snow, may occur sporadically in the dry months. This difference in rainfall distribution, together with more frequent frost in Simien, may considerably affect the times of appearance of insects and the flowering of plants. It may also affect the geographical distribution of species.

The above remarks can be amplified from my own experience. In the Gughé Highlands and the adjacent country—which, as stated, are not typical of the highlands as a whole—I met with frequent rain and thunder in October, November and December 1948. In the mountains torrential showers began and ended abruptly, sometimes starting again after a sunny interval, but not usually lasting very long. Local countrymen told me that some rain is expected in every month. Yet the total annual rainfall may not be very great.[55]

Weather encountered in 1952. In Simien the Rains doubtless begin and end at dates varying in different years (I have found little information about this), but are heaviest in July and August. Delays on my outward journey, at sea and in Asmara, adversely affected my programme. Instead of reaching the high mountains before the Rains ended, or soon after their close, I did not arrive at the district-centre, Debārec, till 7 November, and only started on the mountain-trek on 15 November, when the country was already drying up.

From my arrival at Asmara on 6 October, excepting afternoon thunderstorms on 23 and 24 October, I saw no rain till 28 November, when a sharp afternoon shower fell at Lori (about 11,500 feet). During a torrential thunderstorm the following night, 29 November, hail, melting as it struck the ground, nearly washed us out of our camp. More rain and thunder followed on the nights

[54] The said map was adapted from that in the *Guida*, p. 47.

[55] See my previous paper, 1952, pp. 114–115. I also cited the similar experience of Père Azaïs and M. Chambard in September and October 1926.

of 1 and 2 December and in the afternoon of 3 December. The high peaks were white with frozen hail for days afterwards, and more hail fell at times till late in December. Even at Derasghié Maryam (about 9800 feet), in the south of Simien and some miles from the highest mountains, rain fell on the night of 20–21 December.

Rainstorms also occurred at this time on the plateaux at moderate altitudes north of Simien. But such weather was considered ' exceptional '. In the mountains the countrymen were annoyed at the interruption to barley-harvest, on which they were busily engaged. The local men with me had not taken the precaution of digging a trench on the sloping ground at Lori, which would have saved our tents from being flooded.

The question how often real snow, as distinct from hail, occurs in Simien, is discussed below.

Temperature. Few exact records can be given because, despite all precautions, my maximum and minimum thermometers were broken early in the trek, leaving me only a good ordinary thermometer.[56] During the hot hours of the day the sun was powerful. Even on 11 December 1952, at my highest point, above 14,000 feet on Degien, the sun was hot though the air in the shade was cold, while little patches of ice lay on the rough stony slopes and many little cascades were frozen. For comparison, some 80 years ago Raffray recorded a temperature of only 11° C. (between 51° and 52° F.) in full sunshine at midday in September on Mt. Abũna Yosef at about 4000 metres or 13,000 feet (1885, p. 300).

Frost. In the Gughé Highlands, during December 1948, frost only occurred on one night, 20–21 December. In my camp on Mt. Tola, at above 10,000 feet, the minimum was usually about 40° F., but the cold was damp and penetrating. By contrast, during my trek in Simien, 15 November to 30 December 1952, the nights were dry and cold, except during the spell of bad weather on 28 November and the following days. The temperature probably fell to freezing point on many nights. In the narrow valley at Arghine (above 11,000 feet) white frosts occurred on the mornings of 25 and 26 November, water in our pails being covered with thin ice on 25 November. Hoar frost also covered the grass near Mindigabsa (above 10,000 feet) on the mornings of 28 and 29 December, the ice on water in a basin being nearly ½-inch thick. Recalling temperatures recorded on the plateaux round Addis Ababa in December 1926, I should guess the temperature to have fallen to 25° F. if not lower, during these cold nights in Simien.

Relative frequency of hail and snow in Simien. Though snow appears to be much less frequent than hail, snowfalls are fully authenticated in a number of cases. They may occur in several months, not confined to one season.

On my journey I did not meet with snow, but with hail which (as stated above) lay frozen, whitening the peaks for days. Incidentally hailstorms are far from rare anywhere in the highlands of Ethiopia, from about 8000 feet upwards. For instance, one day early in October 1948, hailstones were piled a foot deep in gutters in one part of Addis Ababa, while other parts of the capital remained dry (as I noted, 1952, p. 113).

Earlier writers who recorded seeing the mountains of Simien snow-covered genuinely thought so but, if they were far away, it is uncertain whether they saw snow or frozen hail. When the archaeologists Theodore Bent and his wife, early in 1893, saw from Axum the mountains of Simien ' heavily covered with

[56] It was impracticable for all delicate instruments to be carried personally. I always carried my aneroid, compass and field-glasses when moving from camp to camp, and my two cameras were also carried. But the thermometers in their case were packed among clothing in a steel mule-trunk. This had been enough to protect them on previous journeys, but I suppose that, in Simien, the jarring of the mule-trunk against walls of rock in hollow defiles, too narrow for a loaded mule or horse, snapped the thermometers.

snow ', and stated that this was ' unmistakable ' during their ten days' stay, they were over 50 miles from the mountains (see Bent, 1896, pp. 144, 154).

Probably hail and/or snow may fall in almost any month. Though it is unnecessary here to go back to classical authors, or even to the description of snow on the mountains early in the 17th century by Father Lobo, yet several more recent well authenticated falls of real snow are mentioned below.

According to Hövermann (1954) the differences between travellers' records are explained by fluctuations in the snow-line. The first example given below of real snow, in 1807, occurred during a period when the snow-line was very low. On the other hand Bruce's travels (1768–73) fell in a time when the snow-line had receded above the highest peaks. If this be correct, it is not surprising that Bruce never saw snow, and added ' nor did I ever see ice in Abyssinia, not even on the highest and coldest mountains ' (1790, vol. 3, p. 328). Yet thin ice on water in pails, etc., is frequent enough at the present time.

The examples of real snow to be mentioned are as follows :—

(1) Nathaniel Pearce, having crossed from the east to the west bank of the Tacazzé, when climbing the Simien mountains on 18 October 1807, encountered a heavy fall of snow which did not (in his words) ' come down with violence, but quietly descended in large flakes, like feathers '. On the previous day, 17 October, the air had been piercingly cold, while ice and previously fallen snow lay in every hollow. Later that year, when returning eastwards on 24 December, he met with another fall of snow which lay so thick that he could not easily make his way through it ; while on 27 December he found the Tacazzé swollen, and only re-crossed the river with difficulty.[57]

(2) Powell-Cotton records that, in the last days of June 1900, there were slight falls of snow and hail, and very cold nights, in the high Simien mountains. He also describes ' a cutting wind and driving sleet ' and the peaks being more than once whitened with what he took to be snow. He was told that snow may lie two feet deep in August (1902, pp. 369, 478).

(3) A recent record, authentic and vivid, is that of Col. H. E. Hebbert in his unpublished journal (amplified by personal letters to me). On Mt. Buahit, above 14,700 feet, 8 May 1943, ' there was snow in all the hollows, and we (Col. and Mrs. Hebbert) snowballed each other, and took some down to show the others '.

The above accounts relate to early May, late June, mid-October and December. To these months may be added August, if Powell-Cotton was correctly informed, as was probably the case.

C. NARRATIVE

> Away to the north, where the cliffs ended, was one of those vast fields of fantastic rock-scenery to be seen nowhere but in Abyssinia ; one might imagine oneself to be gazing on the playground of a race of giants, who had vied with each other in setting up as many huge buildings of every sort, as close together as possible, and had then run off and left the lot unfinished. Minarets and domes, castles and cathedrals, sphinxes, obelisks, and pyramids, all seemed to be there in endless profusion—small wonder the old writers more than half believed Simien was an enchanted land !—*P. H. G. Powell-Cotton, A Sporting Trip through Abyssinia*, 1902, p. 361.

My purpose is to set on record the conditions under which biogeographical research was carried out in high Simien in 1952, together with observations on

[57] Nathaniel Pearce accompanied the Mission of Lord Valentia to the Ras of Tigré in 1805. Henry Salt was Valentia's secretary and draughtsman. When Salt left Abyssinia in November 1805, Pearce remained in the country in the service of the Ras. Salt was sent by the British Government to Abyssinia a second time in 1810, as head of a Mission ; he was then met by Pearce, who escorted him from the coast to the interior and back. Pearce and Salt, therefore, were not together when the snow-storms occurred, but the facts cited above, with many other of Pearce's experiences, are given in full by Salt (1814, pp. 283, 287 ; the former passage was recalled in 1950 by Cheesman, whom I cited, 1952, p. 115). It may be added that Pearce's *Life and Adventures*, written by himself and edited by J. J. Halls, were published in 1831.

natural history and cognate matters not discussed in the foregoing Parts. With ever-increasing mechanization of transport, a mule-*safari* over mountain-tracks becomes a less frequent method of travel. I have also tried to convey something of the strangeness and grandeur of the scenes among which I worked; the landscape, despite its grimness, has a beauty of its own, and has impressed even widely experienced travellers by its almost unique character.

The quest for endemic fauna necessitated seeking, above all, the following types of environment; (1) remnants of mountain forest; (ii) the dense scrub of tree-heath and accompanying plants covering slopes too steep and rocky for cultivation, even at altitudes where every possible expanse is cultivated; and (iii) places above the limit of tree-heath, where the vegetation is largely dominated by the giant *Lobelia rhynchopetalum*.

The country, the seat of an ancient civilization largely peculiar to itself, has been cultivated, wherever possible, from the remote past, with consequent profound effects on its flora and fauna. The crops and local agricultural methods of the several peoples through whose territories my route lay are interesting in themselves, while to take note of these matters may contribute to the success of the research in hand.

Preliminary Information

Routes and distances. Simien was approached from the north, Asmara, capital of Eritrea, being my base, (Addis Ababa was not visited on this journey.) The whole route is shown in Fig. 5; from the port of Massawa to Asmara, thence south, crossing the frontier of Ethiopia, to Debārec, district-centre of Simien, and subsequently farther south to Gondar and the north shore of Lake Tana. The distances are: Massawa to Asmara (by rail), about 75 miles; Asmara to Debārec (by lorry), about 270 miles; Debārec to Gondar, about 64 miles, and Gondar to Gorgora, at least 35 miles (both these stages by lorry). The total distance from Asmara to Lake Tana was, therefore, about 369 miles, and the return journey to Asmara followed the same route. Finally I left Asmara on 7 February 1953, crossing the western province of Eritrea by motor to the Sudan frontier at Kassala, a distance of nearly 250 miles.

The journeys by motor-lorry were spread over several days apiece, to avoid hurry and because the condition of some stretches of road, on which gangs were repairing the neglect of years, precluded fast travel by heavy vehicles. Changes in the course of the motor-road to Gondar, since the Italian *Guida* was published in 1938, render exact statement of distances difficult.

The trek in high Simien itself, during which my main purpose was accomplished, is mapped on a larger scale on the folding map opposite p. 58. The route lay entirely east of the motor-road leading to Gondar, and away from any track possible for vehicles. The large irregular circuit in the mountains, lasting 46 days, with halts at 15 different camping places, was covered by a caravan of mules and horses assembled at Debārec. The distance was approximately 123 miles. Some tracks were traversed twice, going and returning, as indicated by arrows on the folding map. The total may really have been more; it is impossible, on maps so incomplete, to compute the windings of mule-tracks, particularly the almost countless loops up steep-sided lateral valleys and round their heads, made to avoid the abrupt descents and ascents which a direct crossing would have necessitated.

Populations and languages. Simien lies in the province of Beghemder, part of the old kingdom of Amhara, the home of the dominant race, whose tongue has now become the official spoken and written language of the whole realm of Ethiopia. The city of Gondar, now the provincial capital, was in the past for a time the capital of all Ethiopia. Beghemder (or Begamdir) is said to

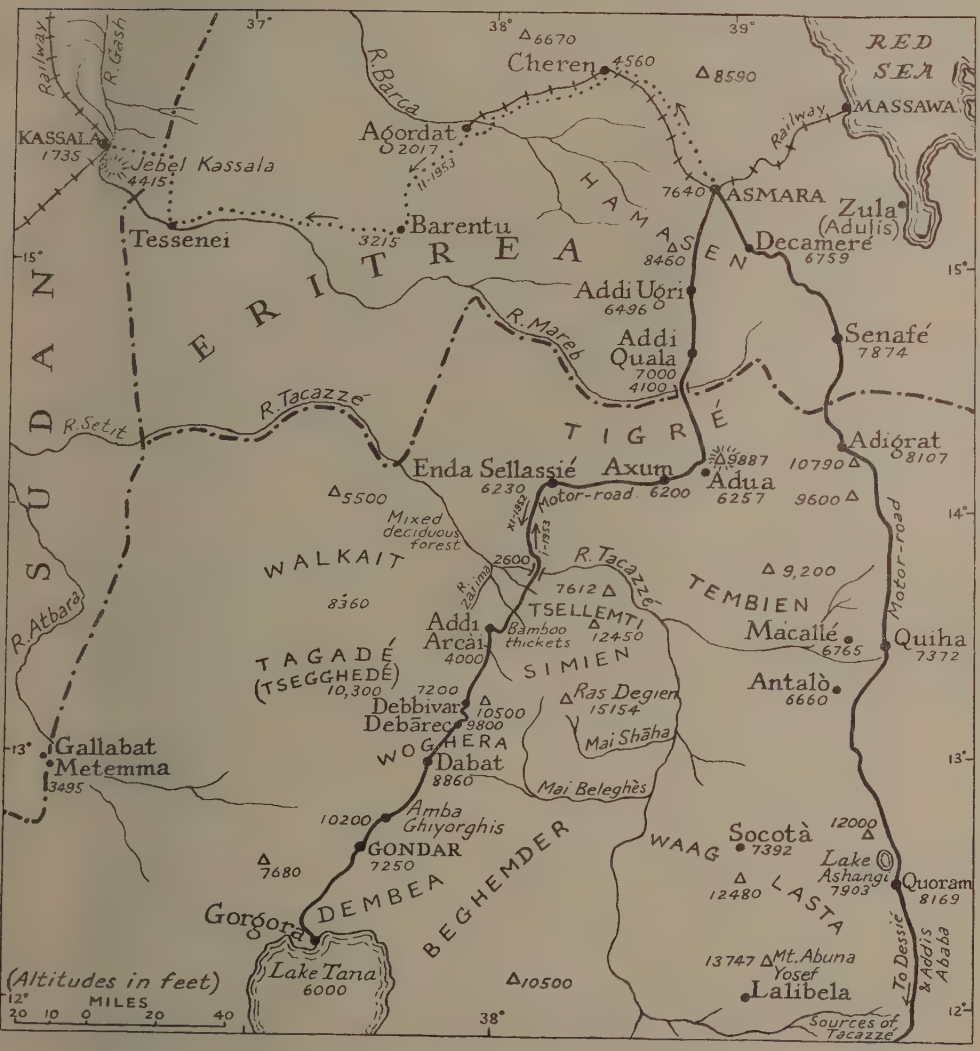


FIG. 5.—Map showing the whole route, except the caravan journey in Simien (for which see second folding map, opposite p. 58)

mean the ' land of the Bega ', one of many peoples classified as ' Northern Cushites '.[58] Thus my interpreter, Ghidello Woldesayek, had to deal with fewer languages on the Simien journey than he had when accompanying me to the Gughé Highlands in 1948–49 (compare remarks on ' segregated populations ' in my earlier paper, p. 127). In 1952–53 our quick passages through Eritrea involved only slight contact with its peoples. After crossing the frontier into Ethiopia, *amharinya* (Amharic) usually served, and was the only language needed in Simien and south of that district. In Tigré, the northern province of Ethiopia, between the Mareb and Tacazzé Rivers, we heard Tigrean (*tigrinya* or *tigrai*), and even south of the Tacazzé some names of plants, for which I asked, were given in Tigrean.[59]

Simien is also the home of an interesting people professing the Jewish faith, though not racially Jewish, and living among the Coptic Christians. Industrious and traditionally skilled in iron-work, they prefer to be called *Israeli*, but are usually known as *Falasha*, a term not unnaturally disliked, as it has come to signify an ' exile '.[60] Probably they kept their Jewish faith in ancient times, when the surrounding tribes adopted Christianity. They differ little outwardly from their Coptic neighbours—though not wearing a silver cross on a blue cord round the neck, as is (or was) the custom among the Christian peasantry. The cities, Asmara and Gondar, have also large Muslim populations.

(The foregoing slight indications are all that can be given here. Detailed ethnological accounts of the peoples of the Lake Tana region will be found in several works forming the latter part of vol. 1 and the whole of vol. 2 of the *Missione di Studio al Lago Tana* ; though these writings concern the inhabitants of the lake-basin, much of the information may also apply to those of the mountains.)

Houses. The Sudanese Arabic word *tukul* is used in this paper as a convenient term to include all the ordinary houses seen in Simien ; that is, round huts with conical thatched roofs, projecting eaves and walls constructed either of wooden uprights or, in the treeless mountains, usually of stone. More precisely the Amharic word for a house, *bēt* (or *biēt*), should be used, combined with another word, to designate the particular form of house, or the materials used in its construction. Ground-plans of several types are given in vol. 2 of the *Missione di Studio al Lago Tana*. In Tigré houses are frequently of other forms ; in the country many are rectangular buildings of one storey, with stone walls and flat roofs (for both types, see Plate 6).

Asmara (6 *October*–3 *November* 1952 ; 26 *January*–6 *February* 1953)

Asmara was reached on 6 October, about 11 days later than intended, owing to unexpected delays during the sea voyage to Massawa. So my arrival coincided with the unforeseen advent of the Emperor of Ethiopia, with a large attendance, to celebrate the (then) recent federation of Eritrea with his country. Access

[58] See Sir Charles F. Rey, 1927, p. 50, and *Guida*, p. 81.

[59] Ghidello, a Galla who travelled nearly 700 miles north from Addis Ababa to rejoin me at Asmara, knew no Tigrean, and found no use for his native Galla tongue in the north. But he speaks Amharic, French, Italian and some Arabic. Two Eritreans, engaged at Asmara, spoke Tigrean, also Amharic and Italian. I used principally French, as on my previous journeys in Ethiopia, also a limited amount of Italian with the Eritreans and the police escort.

[60] Canon Matthew explains that *Falasha* is derived from a Geez (Ethiopic) verb *falasa*, meaning ' to migrate'. In modern Amharic the present participle is used for ' emigrant '. Thus the original meaning of ' Falasha ' was 'emigrants', i.e. a tribe who had emigrated from southern Arabia to northern Ethiopia. But when they came to regard themselves as Israelites, the meaning ' exile ' became attached to the name. See also Rev. H. A. Stern (1862, p. 184) ; remarks about the Falasha are also given by C. F. Rey, *Unconquered Abyssinia*, 1923, pp. 58–59.

to high officials was impossible during the Emperor's visit. Not till 22 October could an interview be contrived with his newly-constituted Personal Representative in Eritrea, Bitwodded Andarghé Massai who, after receiving me most courteously, sent me in a few hours an all-important document, a letter in Amharic addressed to the District Chief of Simien. But this delay, combined with scarcity of means of transport and other difficulties, caused my preparations to be drawn out for a month.[61]

However, much could be learnt in this agreeable highland city. Asmara (meaning a 'flowery wood') was only a wood before Ras Alūla, a redoubtable 19th century chief, made it his capital of the territory later named Eritrea, which the Italians occupied in 1889. As seen in 1952, with a population probably over 100,000, Asmara had well-kept native quarters to the north and good European streets to the south. Of the latter, those of the earlier Italian colonial period consisted of less imposing buildings, while several streets built during the Fascist régime were very broad, with lofty shops and houses.

In the grain market many local products were displayed. Its floor was heaped with great mounds of barley, wheat, maize and, above all, millet (*Sorghum*; *dhurra*, in Amahric *māshillā*), different strains of the last-named grain varying in colour.

The near-by wood market was the point farthest from the coast where camels were seen in use. Firewood (probably mostly acacia) was thus carried up from the rugged hill country of the seaward escarpment. But no more camels were met from Asmara southwards to Gondar.

In October garden flowers, temperate and subtropical, mingled luxuriantly. To mention only few, the more exotic plants comprised bougainvilleas and lantanas as creepers, daturas trained as small trees, hibiscus and scarlet-leaved poinsettias, and a nursery-field full of arum lilies; while the more familiar included scarlet geraniums and white marguerite daisies[62] (both forming woody-stemmed shrubs), carnations, African marigolds (*Tagetes*), statice, balsams and scarlet cannas.

Many insects were attracted to garden flowers in October, but difficult to capture in the hot sunshine, with frequently a high wind. Among these were the highland butterflies *Pontia daplidice aethiops*, *Colias electo* and *Lycaena phlaeas pseudophlaeas*, African forms of the Bath White, Clouded Yellow and Small Copper, which re-appeared in the heights of Simien, but were not seen in the intervening lower country.

Honey-bees (*Apis mellifera*) *collecting a protein food*. I described this behaviour, still not fully explained, in an article (1954) briefly recapitulated here. The bees regularly collected, of their own accord, in the open grain market, a substance containing a high proportion of protein but no trace of sugar. This powder, in Amharic *shirro* or *shurro*, is composed mainly of flour ground from chick-peas (*Cicer arietinum*, Amharic *shimbra*) with or without the addition of ground red peppers (Amharic *barbari*), the presence or absence of which apparently makes no difference to the bees. On the other hand, the flavouring of the flour with a Labiate herb (*Ocimum* sp.) may be important, if the bees have learnt to associate its aromatic smell with the flour. The bees grabbed the *shirro*, which is sold for cooking, so greedily, that they often touched the hands of the market women, yet did not try to sting, before flying away with their legs loaded.

[61] My journey coincided with other public occasions besides the Emperor's visit to Asmara. On 6 January 1953, I witnessed the official welcome at Gondar of a new Ethiopian Governor-General of Beghemder; and on 15 February the impressive spectacle at Khartoum, when the British Governor-General proclaimed to many thousands of Sudanese the 'accord' between Britain and Egypt, which resulted shortly afterwards in the Sudan becoming independent.

[62] *Chrysanthemum frutescens* var. *grandiflora*, native of the Canary Islands.

A pollen supplement, rich in protein (usually flour of the soya bean, *Glycine* sp.), is given by bee-keepers at home to help bees rear their broods when pollen is scarce. But there can hardly have been a shortage of pollen at Asmara, where so many flowers, cultivated and wild, were in bloom (as I listed in 1954, p. 76) ; nor have I found out by subsequent inquiry how or when the bees in Asmara started this habit, or whether similar behaviour has been noticed elsewhere.

Vegetation of the eastern escarpment. Asmara lies at about 7400 feet, while the plateau-edge, a few miles to the east, reaches 7900 feet. On the journey up from Massawa, approaching the top, the line climbs a tree-clothed mountain-rampart, above which the uppermost slopes were rust-red with inflorescences of *Rumex nervosus*, a woody shrub, and brightened by the scarlet flowers of an aloe (*Aloe eru*).

Descending later to about 6500 feet, I found, straggling upwards among low succulent euphorbias, a tall bush-*Senecio* (*S. hadiensis*, previously seen in the mountains of the Western Aden Protectorate). Nearby flourished luxuriant clumps of *Pelargonium multibracteatum* (flowers white, tinged with red at the base) ; *Ceratostigma abyssinicum*, a low shrub with deep blue blossoms ; *Barleria ventricosa*, another low shrub, with lavender-blue trumpets ; the bright blue *Commelina latifolia ;* and a low-growing *Hibiscus* with small scarlet flowers (*H. crassinervius*). These and other plants form a delightful association, recalling in general type, though not in all its components, the vegetation of parts of south-west Arabia.

Spread of prickly pear. This vegetation is quite unlike that seen on the long rail journey from Djibouti to Addis Ababa, except in the excess of prickly pear (*Opuntia*) at certain places. The latter gives the country near Arbaroba (a village about nine miles from Asmara, down the road to Massawa), with its little ' adobe ' houses, white-walled and flat-roofed, a superficial resemblance to parts of southern Spain. As I stated (1952, p. 125) *Opuntia* appeared, on my second visit to Ethiopia after 22 years, to have spread greatly. It is to be hoped that the Ethiopian Government, learning from the experience of other countries, will watch the spread of prickly pear.

South from Asmara to Debārec

At length, on 3 November, I left Asmara for Debārec in a lorry with an Ethiopian driver and the three men (Ghidello and two Eritreans), engaged for the whole journey. The 270 miles, taken purposely in short stages, occupied nearly five days (3–7 November).

The valley of the Mareb. Some 57 miles south of Asmara the road plunges over the edge of the Hamasen plateau at about 6700 feet, descending with many hairpin-bends more than 2600 feet into the valley of the Mareb. This river flows mainly west-north-west towards the Nile ; but in the farthest part of its course, as the Gash (Italian, Gasc), hardly recognizable as a permanent river, it dissipates itself in the plain north of Kassala.

The part of the Mareb valley traversed by the road is, despite its precipices and the surrounding mountains, less sharply defined than the valley of the Tacazzé, farther south. The Mareb valley is much broader, with smaller hills and ridges in its floor. Nevertheless the heat increased and characteristic vegetation appeared. Among the most noticeable plants were the very thorny bush, *Barleria induta*, covered with golden-yellow trumpet-shaped blossoms, also a low prickly bush, *Blepharis edulis*, of the same family (Acanthaceae), with light-blue flowers, and a Labiate shrub several feet high, *Otostegia integrifolia*, with silver-grey foliage and greenish-yellow flowers.

South of the Mareb, after the frontier of Ethiopia into Tigré (the northern province) is crossed, a group of scrub-covered volcanic peaks (Plate 1) rises to

the east of the road. These grim mountains, the highest of which, Semaiata, exceeds 9800 feet, lie north-east of Adua. But, north of the outskirts of that town, the road to Gondar branches westward from the direct route to the south, passing through Axum and continuing over plateau country to Enda Sellassié.

Axum. I was (under protest) made to lock and barricade myself for the night of 4 November in a rough little room at a ' Bar ', in the walled garden of which the behaviour of an Indigo Finch (*Hypochera ultramarina*) plainly indicated the proximity of a nest ; a shred of interesting information, having regard to the altitude; 6200 feet, and date. On the return journey in January my tent (which I insisted on using) was pitched in the compound of the local governor, a hospitable Coptic ecclesiastic.

Axum, former crowning-place of the ' Kings of Kings ' of Ethiopia, is still an ecclesiastical centre. The famous monuments, pre-Christian and others, of this centre of the Axumite realm (believed to have been established by immigrants from Asia), whence the later Amharic realm originated, have attracted archaeologists for a long time past ; notably J. Theodore Bent and his wife in 1893. Since 1952–53 Axum has been undergoing systematic exploration by modern archaeological methods.

From Axum via Enda Sellassié to the Tacazzé. On the 40 miles of plateau westward from Axum to Enda Sellassié (' Church of the Trinity ') on 5 November many white storks (*Ciconia ciconia*), migrants from the north, were seen in the fields.

A police escort. Though warned, before leaving Asmara, of recent attacks on vehicles by *shiftas* (bandits) on this road, I was rightly advised not to arm my party. But at Enda Sellassié the local officials insisted that my lorry should be, like every other vehicle, guarded by two Ethiopian policemen with carbines. This was necessary when traversing the broad belt of forest extending from the north slope of the Tacazzé valley, across the foot-ranges of Simien south of that river, to the top of the main escarpment. Occasionally we met vehicles travelling in the opposite direction, when the police escorts would change over, each going back towards their respective police stations.

Primitive methods of threshing and winnowing. In the parts of northern Ethiopia visited, the grain is trodden out by teams of three or four oxen driven slowly round and round the threshing-floor, treading with their own hooves, not dragging any sled or other instrument (Plate 8). The oxen are lightly muzzled with a ring of cords round the mouth ; otherwise, if allowed to eat, they would stand still. So the Old Testament precept, ' Thou shalt not muzzle the ox when he treadeth out the corn ' is not literally followed.[63]

I had not previously seen this method in Ethiopia, and conversely I did not on this journey see any hand-threshing with flails.[64] Winnowing is effected by throwing grain and chaff up into the air with wooden forks, so that the chaff is carried away by the wind. Once I passed an old man and woman simply pouring the grain and chaff from their joined hollowed hands.

Three main agricultural economies. It is believed that the system of ploughing and seed farming, dominant in the districts visited on this Simien journey, was introduced into northern Ethiopia by immigrants from southern Arabia in pre-Christian times. Conversion to Christianity and the spread of this type of agriculture have gone together, extending even in quite recent times, for instance, since the occupation of the southern provinces by Menelik in the present century.

In typically Galla-lands, on the other hand, pastoral life and the existence

[63] This precept, given in Deuteronomy, chap. 25, verse 4, is twice cited in the New Testament, in St. Paul's writings.

[64] Threshing with flails is practised in the south. A large team of people so engaged, west of Harar, is shown by Azaïs & Chambard, 1931, *Cinq Années de Recherches archéologiques en Éthiopie*, Pl. 21, photograph 2.

of immense herds of cattle predominate (as I had experienced particularly in passing through Arussi province during both my earlier journeys).

On the Gughé Highlands journey in the provinces of Walāmo, Gāmo and Sidāmo, the predominant agriculture lay in the plantations of *enset* (*Ensete edulis*), enclosed in fences of split bamboo. This has been termed ' a true African economy ' (Smeds, 1955, p. 35). But the only *enset* seen on the Simien journey were a few trees in the walled quadrangular farm-enclosures built under the Italian régime on the Woghera plateau, and in gardens at Gondar. *Enset* may have been cultivated rather more extensively in Simien, east and south of Debārec, nearly a century ago (see von Heuglin, 1868, p. 198 ; Professor Smeds called my attention to this).

These three main types of farming are not everywhere mutually exclusive. For example, though in Simien arable land predominates, cattle, sheep and goats are kept as well, but not, as far as I saw, in large herds and flocks. On the other hand, there is a great contrast between the use of ploughs wherever possible in the north, and the trenching by hand-mattocks in the *enset*-planted districts of the southern provinces, where no ploughs are to be seen (Plate 7). Nor were ploughs used south of Ethiopia in any part of eastern Africa before the coming of Europeans.

Form of plough used (Plate 7). Mr. Robert Aitken, who has long studied primitive ploughs, told me (vii.1957) that the instrument used in northern Ethiopia is closely related in general structure with that used in northern and eastern Palestine. On the other hand, the plough used in the Yemen is different, being apparently an ' outlier ' of a common Mediterranean type. The subject is complex, as indicated by him in 1956, in an illustrated article (which, however, does not bear on the Ethiopian plough).

Folk-lore concerning animals. The following incidents, occurring near Enda Sellassié, may be recorded here :—

As I stooped to gather wild flowers in long grass, Ghidello (my interpreter) pointed out the complete sloughed skin of a small snake, about the size of a grass snake, which I had not seen. He kept part of the skin, as some local men standing by told him that, if he rubbed his hands with the skin, he would not be bitten by a snake. Presumably this is purely ' superstition '. The only imaginable basis in fact would be if rubbing with the skin were to leave an odour which would deter another snake of the same kind from biting. This, I am told on good authority, is very unlikely. Ghidello remarked that ' les serpents ne manquent pas ici '. But the more dangerous species would probably not occur at that altitude (above 6000 feet).

The other ' animal ' episode took place soon after our departure from Enda Sellassié the following morning. A jackal crossed the road in front of us from left to right. Some of our party took this as an omen of good fortune, while, if the beast had crossed from right to left, it would have been a forecast of ill.[65]

The valley of the Tacazzé. Between Enda Sellassié and the Tacazzé lay much cultivated country, appearing almost empty of human habitations. The little houses, largely of brushwood, form compact villages along the motor-road. There are no ' agglomerations ', small groups of tukuls, as in the centre and south of Ethiopia.

From an altitude above 6000 feet the road leads by a twisting, breath-taking descent of well over 3000 feet into the deep narrow valley. The bridge across the river is at only about 2600 feet, just below a small place called Mai Timchet (Timkat).[66] This steep northern slope is densely forested. Tall frankincense

[65] These incidents recalled fragments of lore about insects, gathered in South-West Arabia in 1937–38, and given in my ' In the high Yemen ', pp. 118–119.

[66] Translated by Bruce (1790, vol. 3, p. 158) ' Water of Baptism ', referring probably to the blessing of the waters and the sprinkling of the people at the festival of Timkat, one of the most important in the Ethiopian church's year. The ceremony is held locally near most churches, in January.

trees (*Boswellia*), in full foliage in early November, were quite bare on my return in late January, then displaying plumes of purple flowers at the ends of their branches.

On this road the descent to the Tacazzé, in its deep narrow valley, is so abrupt, and the steep slope is so densely forested, that the river is scarcely visible from above. There is no panorama of the Tacazzé and the mountains beyond, like that drawn in 1810 by Henry Salt from a point nearly 60 miles to the south-east (see Fig. 6, p. 54).

Owing to recent frequent attacks on vehicles by *shiftas* hidden in the forest, we had not stopped during the descent. At the bridge, however, where the river flowed between steep slopes of forest, then bright green, I asked to halt if ' not too dangerous '. The police escort, considering themselves an ample safeguard, bathed in the *acqua santa* (as they termed it in Italian), but kept to shallow water, as crocodiles frequent the Tacazzé. But we saw none, nor any hippopotamus. Some baboons drinking one by one on the opposite bank, and *totas* (grivet-monkeys) gambolling nearby, were the only larger wild animals visible.

More insects were collected on my return in January ; Carabidae and water beetles on the stony river bed (Plate 2, right foreground of upper photograph), but only one of the remarkable larvae of *Tabanus kingi*, since the others wriggled down horizontally into the silt under an inch or two of water so quickly that I did not at first recognize them as Tabanid larvae.[67]

South of the Tacazzé the road climbs to plateau country again, then descends and ascends over steep wooded ridges as it crosses more than one tributary river. The end of the long day's journey from Enda Sellassié was Addi Arcai, pleasantly situated round a level village green at somewhat above 4900 feet, with an almost perfect temperature, neither too hot nor too cold. The Tigrean name Addi Arcai, meaning ' city of bamboos ', is suitable, for between the south bank of the Tacazzé and this point lie several expanses covered with the only bamboo seen (*Oxytenanthera abyssinica*), here growing not densely, but in separate thickets.

Strange scenery : the landscape of high Simien, with that of Tsellemti district immediately to the north, must surely strike a southward-bound traveller approaching Addi Arcai as fantastic (Plate 3).

The stupendous northern escarpment of Simien proper, forms, with the ranges between it and the spectator, a huge amphitheatre whence converging valleys, separated by sharp wooded ranges, descend to the deep furrow in which flows the Tacazzé. From the maze of ridges rise rock bastions and towers, veritable spires and *aiguilles* of rock. The larger masses have assumed geometric shapes, their precipitous sides descending in a series of widening gradines. To the grotesque outlines are added strongly contrasting colours, the several shades of green in scrub and forest, the light brown of dry grass, and bare rock varying from dark red to black.

Anyone who has seen the Dolomites (as I had) will naturally draw a comparison. But though the forms of the mountains may be equally remarkable in the two cases, the rock of which they consist is entirely different, and the colouring also differs. The colours in Simien are harder. The volcanic rock, blacker or redder as the case may be, has not the delicate grey and other soft shades of dolomitic limestone seen in certain lights.

An equally strange prospect in the reverse direction presented itself later, from the top of the main northern escarpment down over the labyrinth of ranges

[67] *Tabanus kingi* is apparently unique in Tabanidae in that the females lay their egg-masses on stones exposed in streams instead of on overhanging stems or leaves. The larvae live under stones in the swift parts of streams and, correlated with this unusual habitat, they alone among Tabanid larvae have a well-developed anal proleg. See H. E. Hinton, 1955, *Trans. R. ent. Soc. Lond.*, **106**, pp. 486–487.

FIG. 6.—'A view of the mountains of Samen (Simien) and the river Tacazzé', drawn by Henry Salt in 1810, some 15 miles east of the Tacazzé and 60 miles south-east of the present bridge (from Salt, 1814, opposite p. 353)

to the north. From the edge of the precipice, at altitudes between 11,000 and over 13,000 feet, to the bed of the Tacazzé, is a drop of 10,000 feet. But the river is hidden in its canyon some miles to the north, and the tops of the foot ranges between it and the spectator may be 4000–6000 feet below. The topmost precipice falls almost sheer, nearly 3000 feet, to the uppermost shelves and buttresses (Plates 4, 12).

Later, when traversing the Woghera plateau near its western edge, I looked down, at points between Debārec and Gondar, on a jumble of volcanic formations, conical, pyramidal and truncated, but all indistinct. For the haze is so thick in November, December and January that sharply defined photographs of the foot ranges were unobtainable without infra-red photography. Fortunately Col. Hebbert's photograph (lower on Plate 5), was taken at a clear season (in May 1943).[68]

The Zarīma[69] *valley and the Wolkefit Pass; changes in vegetation.* On 7 November, though only about 55 miles separated Addi Arcai from Debārec, variety of scenery and vegetation enough for several days filled the hours between 8 a.m. and 4 p.m. The road descends steeply about 1400 feet to the bridge over the Zarīma, an affluent of the Tacazzé flowing north-west (Plate 2, lower photograph). The slopes of this valley are richly wooded, much of the forest consisting of *Anogeissus leiocarpus*, a tree superficially resembling birch (see above, p. 30). This and most other components of the forest hereabouts, including the white-flowered *wanzé* (*Cordia abyssinica*) and an occasional wild fig (*Ficus* sp.), were in full leaf in November. But these woods were almost leafless in late January, when, however, several trees displayed remarkable flowers, such as the pink and white trumpets of *Stereospermum kunthianum* and the pink flowers along the branches of *Dombeya* trees, the latter deceptively resembling blossoming fruit trees at a distance.

In February 1770 Bruce, impressed by the wooded valley of the Zarīma, noted that ' on the banks of this river, and all this day, we passed under trees larger and more beautiful than any we had seen since crossing the Tacazzé' (1790, vol. 3, pp. 180–181).

From the Zarīma the road rises, with many sharp curves, to Debbivar, a small post at about 7200 feet, at the base of the sheer topmost precipice. Hence it ascends the face of the huge escarpment to the Wolkefit Pass at about 9900 feet, by hairpin-bends, many of which are cut out of the almost vertical rock (Plate 5, upper photograph). The Italians, who constructed this road, modestly claim it as ' not inferior to the greater mountain-roads of the Alps '. Thinking it quite the equal of the Alpine roads, I was relieved when my driver had successfully negotiated the series of sharp curves.

The vegetation changes rapidly during this last ascent. Procumbent geraniums appear, spreading over rocks, with tufted purple-flowered trefoils (*Trifolium petitianum* and *T. rueppellianum*) and another leguminous plant, *Lotus discolor*, with purple flowers lighter at the base; also an Ethiopian variety (var. *schimperi*) of *Minuartia filifolia*, a creeping rock-plant with small white flowers, and a *Campanula* (*C. rigidifolia*), with pale mauve, dark-veined flowers. The golden *Primula* with waxy leaves (*P. verticillata*) was first seen growing out of the almost vertical bare rock (on the left in upper photograph, Plate 5); a spring, evidently tapped in making the road, coursed down this rock-face.

[68] Raffray's graphic description of these views from the western edge may be compared (*Abyssinie*, 1880, pp. 319–320). Farther south, near to Gondar, though the valleys are still deep and steep-sided, the outlines are more gentle.

[69] This name, transliterated *Zarīma* or *Zerīma*, was sounded with the accent on the second syllable.

Some of the above plants, for instance the trefoils, are characteristic of other high mountains in Ethiopia. *Lotus discolor* is distributed right through the African highlands to South Africa. The *Primula* is confined to northern Ethiopia, but represented by another form of the species in South-West Arabia (above, p. 32); the same applies to *Minuartia filifolia*, which I had previously found in the Yemen, on the summit of Jebel Kohl, a barren volcanic cone north of Sana.[70] I do not recall finding any *Campanula* in Ethiopia before.

Just below the summit of the escarpment there is a swift transition to the zone of tree-heath. There, and on the very edge, *Erica arborea* was in flower on 7 November, with a bush-*Senecio* (*S. confertus*). Also many examples of a gladiolus-like plant (*Petamenes latifolius*) about six feet high, with crimson flowers; these were already going over and the plant was not seen again.[71] Indeed, to view the bulbous plants of the Ethiopian highlands at their best would require a visit during the Rains, when travelling in the high mountains is often impeded, and would seem scarcely practicable in the heights of Simien. Some days later, east of Debārec, I found a belated blossom (purple and yellow) of the iris-like *Moraea schimperi*. Other flowers, not seen at all, but which would be abundant in the Rains, are mentioned on p. 70.

Though the pass to which the motor-road climbs is called Wolkefit (*la salita di Uolchefit*), the name Lemalemo, the 'Lamalmon' of Bruce, is still used.[72] My Italian-speaking senior policeman on the caravan trek told me that 'Lemalemo' was the name for the track and 'Uolchefit' that for the stream. But it is doubtful if this is other than a recent distinction. The Subdistrict Chief of Ambaras, who escorted me, said that the stream had only been tapped by the Italians in building the road.

From the pass, the top of the escarpment, the road descends gradually, only about 100 feet in four miles, to Debārec. As stated above (p. 7), most of the 64 miles thence to Gondar consists of a gradual descent over a tilted plateau (not a sharp descent from a mountain-range).

Debārec is situated near the top of a slope, whence bare grasslands descend, undulating, towards the south (compare the lower photograph on Plate 9). Excepting imported gum trees (*Eucalyptus*) there are few trees close at hand. Despite official helpfulness, it was hard to find an agreeable place to camp; the sites available provided neither shade nor privacy. The middle part of the day was uncomfortably hot, even at 9800 feet, while the fall in temperature at dusk was great and sudden. Warned by the District Chief, I avoided the bottom of a small valley beside a stream, where the dry grass was white with frost on several mornings between 8 and 15 November.

Though an old-established place on the caravan-track to Gondar, Debārec has become the district-centre of Simien only since the construction of the motor-road. In 1922–23, 30 years before my visit, Maydon found a local fitarauri resident there, but the powerful Dajazmach Ayēlu had his mansion at Dabāt, over 15 miles south. In 1900 Powell-Cotton visited 'Inchatkab (Enchetcab), capital of Simien'; nearly a century earlier, in October 1807, Nathaniel Pearce also visited the (then) Governor of the 'Province of Samen' at that place. On 25 December 1952, a place pointed out to me as Enchetcab appeared to consist only of a group of tukuls in open fields. But provincial and national

[70] Scott, 'In the high Yemen', p. 154.

[71] In my article in *Webbia* (1955, p. 430) the *Senecio* was erroneously mentioned as 'probably *S. myriocephalus*' and the *Petamenes* as 'possibly *Oenostachys sp.*'. The specimens at that time were mislaid, but they subsequently came to light, and were identified as given above.

[72] See Bruce, 1790, vol. 3, chap. 7 and elsewhere; also *Guida*, 1938, p. 256, where the top of the escarpment is expressively called the *ciglione* (literally, edge) *di Debārec*.

capitals were moved from place to place rather frequently in the history of Ethiopia.[73]

In 1952 Debārec consisted mainly of one-storey shanties roofed with corrugated iron, in two rows at right angles, the space in the angle serving as the market-place. This town lay east of the road, while on rising ground to the west stood the District Chief's office and the police station, where the hours were regularly struck on a long metal cylinder suspended between two posts. In the outskirts new houses were rising; not tukuls, but one-storey rectangular structures with walls consisting of brushwood (largely bush-*Hypericum*) and roofs of corrugated iron.

The place looks almost deserted, except on Wednesdays, when some thousands of people assemble for the weekly market, riding or walking, along the road if it happen to lie in their way, but still more by old tracks over the grassland, converging out of the empty-looking landscape on the market-place. There cattle, sheep, goats, horses and donkeys are on sale. Many kinds of produce included two plants: rue (*Ruta graveolens*), in Amharic *tena Adam* ('health of Adam'), used for mixing with red pepper (*barbari*) as a flavouring; and myrtle (*Myrtus communis*), called *addēss*, from which a perfume is made, to mix with the butter put thickly on women's hair. In this assemblage almost no European dress was in evidence. The costume was as it used to be in all country places 30 years ago; flowing *shammas* universal, men and most women bare-headed. Many women carried old-fashioned parasols (permanently open) of plaited straw, usually bound round the edge with cloth (two scenes at Debārec market are shown on Plate 10, and the local crafts of basket making and cotton spinning, at places north of Debārec, are shown on Plates 8 and 9).

Such entomologizing as was possible at Debārec during a week's preparations (8–15 November) consisted mainly of collecting aquatic Coleoptera and Hemiptera in small streams, flowing down the gentler slopes away from the escarpment, with little waterfalls a few feet high at intervals. I here tried out satisfactorily two water-nets specially made with very strong frames of thick steel wire to resist rapid movements among rocks and stones. Minute Coleoptera were found in the damp clay of the steep banks.

Local movements of birds. During this week at Debārec in November groups of Thick-billed Ravens (*Corvultur crassirostris*) and of the dark-plumaged endemic Wattled Ibis (*Bostrychia carunculata*) frequented the rolling grassland. In the early morning the ravens would almost walk into my tent, but the ibis, more shy, kept farther away.

On my return to Debārec at the end of December, after the trek in the mountains, several species not seen in November had appeared; the Pied Crow (*Corvus albus*); the Cape Rook (*Corvus capensis kordofanensis*), which puffs out its throat and breast at intervals; and a large chat, almost certainly the Hill Chat (*Pinarochroa sordida sordida*).

What occasioned the appearance of these species later in the dry season is unexplained. They are all characteristic birds of the high plateaux. I have no evidence of movement of birds from lower zones upwards, or the reverse. This accords with the statement of K. M. Guichard who, discussing the birds of Addis Ababa and its environs, remarks 'there are no noticeable vertical movements to or from the high plateau at any period' (1950, p. 156).

[73] Debārec has been spelt in various ways on maps. 'Davarik' is shown by Salt (1814) on his folding map, opposite p. 137. Maydon (1925) scarcely distinguished the names Debārec and Dabat, calling them respectively 'Davark' and 'Davart', perhaps due to the names being slurred by local people. For Powell-Cotton's visit to 'Inchatkab' see his book (1902, p. 352). Pearce's visit to that place in 1807 is recounted by Salt (1814, pp. 283–284).

The Caravan Journey in High Simien

At Debārec 16 good mules and horses were assembled ; three riding animals (mules for myself and Ghidello, and a horse for the cook) and 13 pack animals, hired at a reasonable rate from a *nagadras*, one Teshāla Tamarat, fluent in Italian. A contract, drawn up by myself, was signed by us both before the District Chief. After 46 days' trek the total sum payable, 986 Ethiopian dollars (nearly £141), was agreed without difficulty.

Besides two regular uniformed police (with carbines) assigned as escort, I engaged two local men, to pitch and strike camp and for other duties. We were accompanied by the Chief of the Subdistrict of Ambaras, Kanyazmach Waratta Ayēlu (son of the previously mentioned late Dajazmach Ayēlu), a helpful countryman who only left us once, when he rode back to Ambaras for a few hours to supervise the harvesting of his barley.

A list of camping places was written out in order in Amharic, to be shown to the local headmen by the police escort. Not knowing the places beforehand, I could only intimate the type of country I wished to visit. But the route which I was advised to follow proved on the whole the most practicable.

The map of the caravan trek shows the names and dates of my 15 successive camps (or 16, if two halts at the first place, Mindigabsa, on the outward and return journeys, be counted separately). The whole route lay within an area little over 30 miles from west to east and 20 miles from north to south. But what earlier travellers wrote of the huge scale of the escarpments and the ' dizziness ' of the precipice paths was not exaggerated. The local people, if not on foot, ride on mules, carrying produce or baggage on donkeys. Even these country people have to dismount in places. Some tracks are so narrow that men and pack animals travelling in opposite directions can scarcely pass.

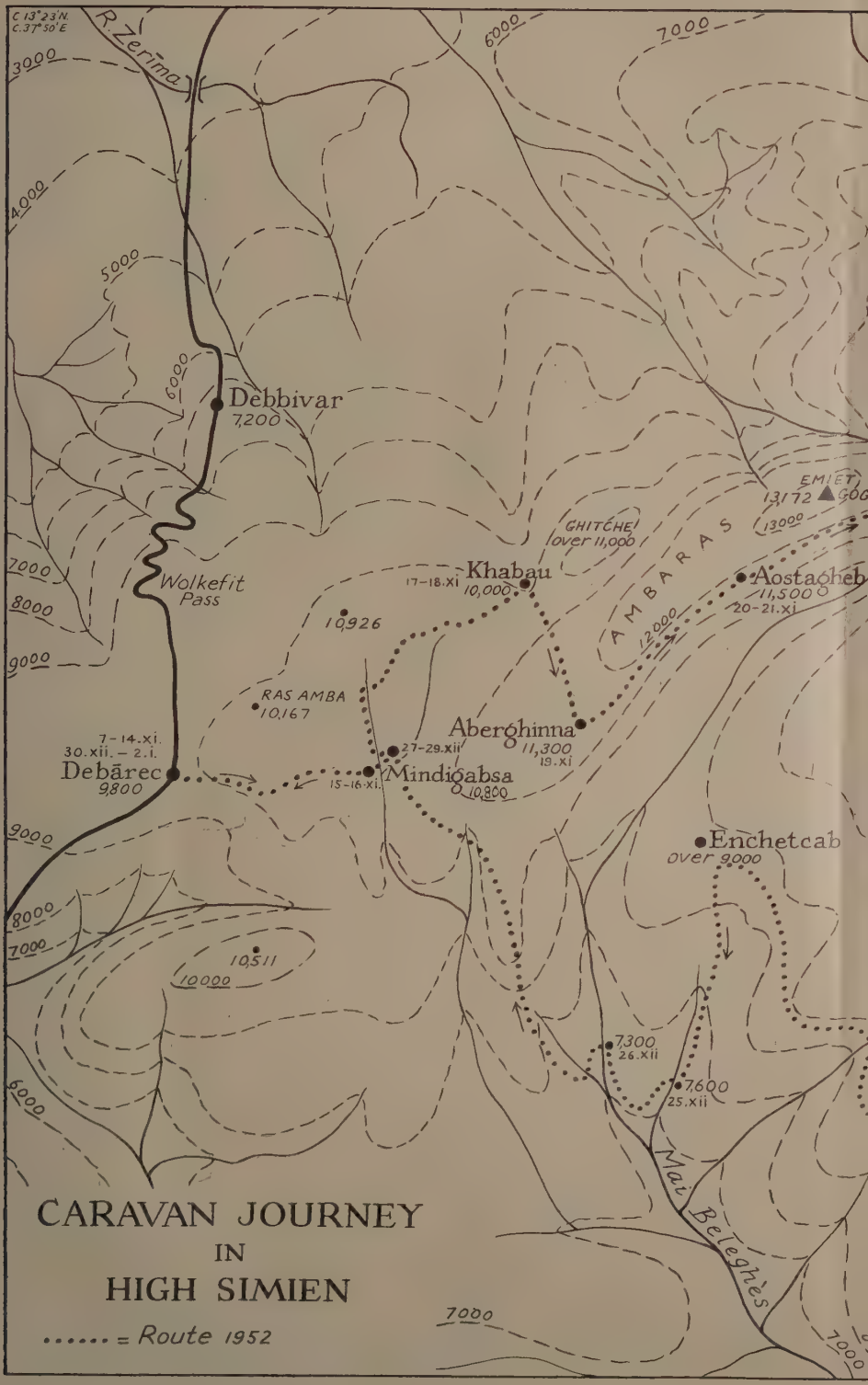
The route is treated below in subsections, followed by Section D, devoted to the most spectacular plant of Simien, *Lobelia rhynchopetalum*, with its associated animals.

Debārec to Khabau (15–18 *November*)

Passing south of a rounded mountain[74] over 10,000 feet high, the track led up steep valleys, widening in places into marshy ground, to grassy downs at Mindigabsa (about 10,800 feet, or 1000 feet higher than Debārec), a pleasant place, though one's way must be carefully picked among the rocks plentifully strewn in the grass. Both the Abyssinian wild rose (*Rosa abyssinica*) and *Clematis simensis* were mostly only in bud, their flowering season being evidently the same as much farther south, round Addis Ababa. These plants flower mainly after the Rains when, from a naturalist's standpoint, there is a second springtime (Scott, 1952, p. 112). The pure white flowers of the rose were at their full in December, and passing over in January.

A day (16 November) was spent in a valley east of the camp, by a southward-flowing torrent, beyond which rose a slope densely covered with tree-heath up to 20 feet high, at the zenith of its flowering. For some reason its myriads of tiny bells, really pure white, seemed from a distance to impart a blue colour to the hillsides. Bush-*Hypericum* was already flowering here and there, though it only reaches full bloom later, continuing into the dry months long after the tree-heath is over. Among this scrub grew many tall kniphofias, with upper flowers red and lower flowers yellow. Insects were collected beneath stones in the torrent-bed, among the roots of tussocks of grass and by beating foliage over a net.

[74] Kanyazmach Waratta called this mountain, immediately north-east of Debārec, ' Ras Amba ', thus distinguishing it from his own subdistrict, Ambaras (pronounced ' Amba Ras '), farther east.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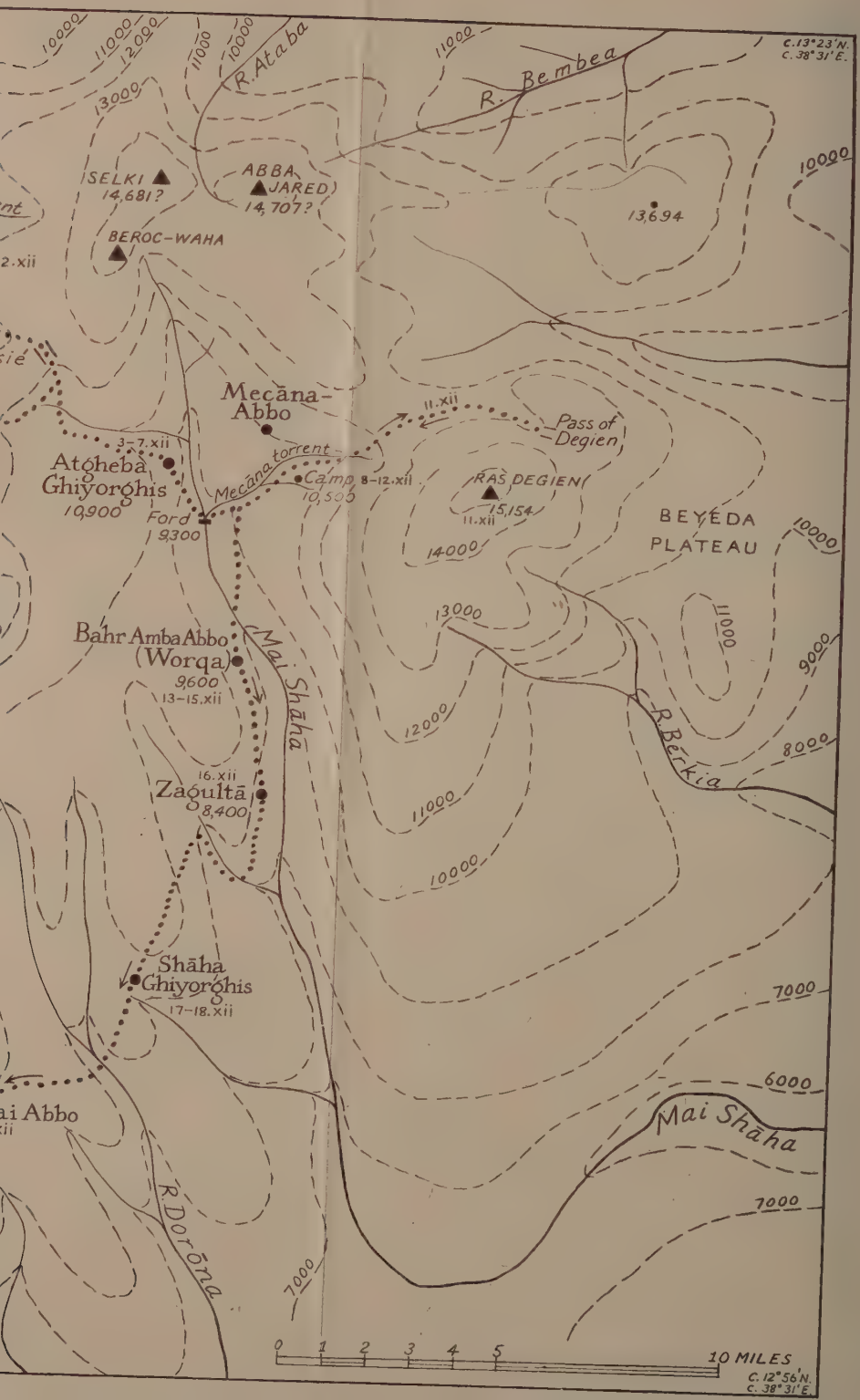
6000
7000
8000
9000
10000
Debbivar
7,200
Wolkefit Pass
10,926
RAS AMBA
10,167
7-14.xi.
30.xii.-2.i.
Debārec
9,800
15-16.xi.
27-29.xii.
Mindigabsa
10,800
17-18.xi.
Khabau
10,000
GHITCHE
over 11,000
AMBARAS
Aberghinna
11,300
19.xi
Aostagheb
11,500
20-21.xi
EMIET
13172
Enchetcab
over 9000
10,511
7,300
26.xii
7600
25.xii
Mai Beleghes
CARAVAN JOURNEY
IN
HIGH SIMIEN
..... = Route 1952


C. 13°23'N.
C. 38°31'E.
R. Ataba
R. Bembea
SELKI
14,681?
ABBA
JARED
14,707?
BEROC-WAHA
13,694
Mecāna-
Abbo
11.xii
Pass of
Degien
3-7.xii
Atoheba
Ghiyorghis
10,900
Mecāna torrent
Camp 8-12.xii
10,505
Ford
9300
RAS DEGIEN
15,154
11.xii
BEYEDA
PLATEAU
Bahr Amba Abbo
(Worqa)
9600
13-15.xii
Mai Shāha
R. Bérkia
16.xii
Zagultā
8,400
Shāha
Ghiyorghis
17-18.xii
Mai Shāha
R. Dorōna
0 1 2 3 4 5 10 MILES
C. 12°56'N.
C. 38°31'E.

On 17 November a ride (lasting from 10.15 a.m. till 4.45 p.m.) led over varied country to Khabau. A little north of Mindigabsa the track crossed valleys where grew many giant lobelias (*L. rhynchopetalum*), the first seen. But the most striking part of the track wound round the head of an upper tributary of the Mai Beleghès, which has cut so far back towards the main northern escarpment as to leave only a narrow isthmus between the latter and the sheer precipices of the tributary valley. Despite the necessity of dismounting and walking with eyes fixed on the narrow path—not looking over the edge—the place is memorable for the grandeur of the scenery and the variety of flowers. The latter included white *Arabis alpina*, growing well over a foot high among the stems of bushes, purple *Aster richardi*, and *Swertia schimperi*, with very beautiful blue-purple blossoms. In contrast with these low montane plants, the giant fennel (*Ferula communis*), abundant in scarcely accessible spots, stood quite six feet high, with its yellow umbels not yet fully opened, but its radical leaves already withered and brown.

Khabau lies just west of Ghitche (the ' Geech ' of Maydon, 1925), a smaller massif rising above 11,000 feet, almost detached from the main escarpment, whence it is separated by an abyss surrounded by 3000-foot precipices. Camp was pitched on a steep grassy declivity dotted with thickets of bush-*Hypericum*. Though the ground appeared to slope to a stream, it really ended abruptly at the edge of the precipice. Among the *Hypericum* grew a bush-*Senecio* (*S. confertus*), from the heads of which flower-haunting beetles were collected.

The Ambaras Ridge and Arghine (19–24 *November*)

Turning away from the main escarpment at Khabau and crossing the southern part of the broad ridge of Ambaras, the track then led along the south-eastern slope of the ridge. A night (19–20 November) was passed at Aberghinna and two nights (20–22 November) at Aostagheb.

The upper part of the ridge consists of bare rolling uplands, where crops had then already been harvested and ploughmen with ox-teams were at work. But on the more sheltered slope ripening crops of barley and flax were not yet reaped. This apparent contradiction was explained by Kanyazmach Waratta as due to a local system of crop rotation ; fields periodically lie fallow, so that times of sowing differ in closely adjacent areas. This was noted by Bruce when crossing ' Lamalmon ' (the Wolkefit Pass) in February 1770 : ' they plow, sow, and reap here at all seasons . . . in one place, people busy cutting down wheat ; . . . others at the plough ; and the adjoining field had green corn in the ear ' (1790, vol. 3, p. 188). I was told that one-grained wheat (*Triticum monococcum*), which Ghidello called *adja*, is somehow used to relieve rheumatic pains ; this was still green, less advanced than any crop on the slope nearby.

The south-eastern slope overlooked the deep canyon of the upper Mai Beleghès.[75] At one point, in the grain fields hundreds of feet below, a troop of several hundred *gelada* monkeys of many sizes, adults and young, witnessed to the abundance of these animals.

Higher up, above the track, grassy slopes too steep and rock-strewn to plough were dotted with palest mauve flower-heads of knapweed (*Centaurea varians*), while innumerable stalkless thistles (*Carduus* sp.) were attracting Painted Lady butterflies (*Vanessa cardui*). Several Small Coppers (*Lycaena phlaeas pseudophlaeas*) were collected in a similar spot resembling, but for the volcanic rocks, an English down-side.

A festival. The remotely situated church of St. Michael near Aostagheb,

[75] This uppermost tributary, descending from the north-east, is marked ' Serecaca ' on the 1 : 500,000 map (ND. 37/5, 3rd ed., 1946). But I did not hear that name used.

where a local festival took place on Friday, 21 November, has its precincts enclosed by a wall of great, rough stones. The little circular thatched building stood in a hollow and (like so many) near a spring. Its builders had therefore been obliged to erect it on extremely rocky, uneven ground. Consequently a procession during the ceremonies had to climb up and down over the rocks.

These festivals, beginning before dawn, continue for hours. At about 11 a.m. the priests and lay singers (*debteras*), under large trees surrounding and almost hiding the church, were chanting to the subdued accompaniment of drums and the metallic ringing of their sistra, raised in union at intervals. Then they entered the church, emerging later slowly in single file, headed by a young man ringing a bell, followed by an ecclesiastic holding open a diptych displaying sacred pictures venerated by hundreds of people assembled from the empty looking countryside. The women, in particular, uttered their tremulous shrill cry of joy, '*ililta*', during parts of the ceremonies.[76] Outside the precincts stood rows of baskets and large earthenware jars (*gombos*), containing food, beer (*talla*) and probably mead (*tej*), ready for the secular feast due to begin about 2 p.m., after the religious service.

The chief's residence. Near this church lay the homestead of Kanyazmach Waratta, consisting of groups of thatched tukuls and small granaries, enclosed in several separate zareebas of brushwood (Plate 6, lower photograph). Among members of his family and household, we met his wife and, notably, his mother, widow of the famous Dajazmach Ayēlu, a dignified old lady who had become a religious Sister.

Arghine[77]. On 22 November, at the north-eastern end of Ambaras ridge, crossing the torrent, we camped on its east bank at Arghine. The stream flows in a ravine, but the valley, narrowing to its head, is pleasant, its slopes being densely wooded with tall tree-heath, among which grew the beautiful 'everlasting', *Helichrysum formossisimum*, with tussocks of grass and other low plants.

Maydon (1925) stressed the grimness of the 'abysses' of Simien; may not these gentler valleys, with streams flowing away from the main northern escarpment, be called its 'recesses'? In this recess some of the greatest specimens of *Lobelia rhynchopetalum* occupied me entomologically, also collecting by other methods (Plate 11).

Occasional frosts. At these altitudes the nights, though cold, are not always frosty. White frost on the grass and thin ice on water in camp pails occurred at Khabau (above 10,000 feet) on 18 November. At Arghine, well over 11,000 feet, the nights of 23–24 and 24–25 November were particularly cold; on the morning of 24 November the hoar frost was thick and there was ice on the pails. But insects were still active during the warm hours of the day.

At Arghine and in other steep-sided valleys which the sun's rays did not penetrate till some time after sunrise, the cold was specially agonizing in the extremities during the last few minutes before the rapidly mounting sun chased the shadow from my camp. Presumably this painful tingling resulted from the capillaries, contracted during the night, being rapidly dilated by the increasing warmth; I do not recall having felt it so much on earlier journeys. Miss Beatrice Playne noted apparently the same experience. On her journey north from Addis Ababa to Lalibela, about the end of 1946, describing a start in darkness at 5.30 a.m., she remarked that, even after daybreak, 'it seemed to go on getting colder for a long time'.[78]

[76] *Ililta*, sometimes transliterated *elelta*, has no meaning but simply expresses joy. I am told that in Nyasaland people utter the same sound, but call it *luluta*. (At Aostagheb a new church was being built on higher ground, but still within the outer wall.)

[77] Maydon (1925) wrote 'Argeen'; a French transliteration is 'Arguine'.

[78] See her diary published in *St. George for Ethiopia*, 1954, p. 26.

Cries of shepherd boys. Unfortunately I could not record the raucous cries which resounded across the valley, as boys shouted from one side to the other, when bringing home the little flocks and herds of sheep and goats at dusk. Apparently they bellowed one another's names with a long drawn-out cry, ending in a ' whoop ' quickly repeated several times. These cries may differ from district to district. At Arghine they were not the same as the loud, shrill calls of the shepherd boys on Mt. Tola (Gughé Highlands), who used to begin calling to one another across my camp at dawn. Moreover the Gughé Highland boys, plentifully supplied with pipes made of the local bamboo, varied their vocal clamour with more agreeable music (see my previous paper, 1952, p. 146).

Fewness of wild mammals. Apart from the plentiful *gelada* monkeys, larger wild beasts are apparently scarce. I do not recall even hearing the nocturnal voices of jackals or hyænas. Yet, one night at Arghine a hyæna did approach our mules and horses. A shot fired by the police reverberated down the valley. Probably the beast was not hit, but fled. In the morning four mules were missing ; though hobbled they had strayed a little way, but were soon found.

The Chennec Pass, Mount Buahit and Lori (*25 November–2 December*)

The track beside the torrent leads upwards from Arghine, first to the Pass of Chennec (*c.* 12,186 feet)[79], whence a view opens westward along the huge precipices of the main escarpment. This is visible to a point where bastions of rock project northward from the 13,000 foot mountain, Emiet Gogo, behind which the continuation of the escarpment towards the south-west is hidden. An impression, although inadequate, of its grandeur may be conveyed by Plate 12.

Several mountain plants appeared for the first time at Chennec, notably the pink-flowered heath, *Blaeria spicata*, and *Helichrysum fruticosum* var. *compactum*. But when the track, still following the torrent upwards, curves to the east, ascending the western flank of Buahit, a far stranger scene comes into view. This uppermost valley lies parallel to the main escarpment, so that the steep slopes on its north side are abruptly broken off, forming almost a knife-edge at the top.

The vegetation consists mainly of low compact bushes of *Helichrysum citrispinum*, with white flower-heads and light yellow spines, and countless lobelias up to about six feet high, spaced out over both sides of the valley so regularly as to recall a military formation. The grotesque scene might almost belong to another world. Though a similar association of these two plants covers a great expanse on the precipitous face of Degien itself, some miles to the east, the topography is there less extraordinary than on Buahit.

This plant association does not begin till nearly 14,000 feet, but extends upwards to the tops of the highest mountains (15,000 feet on Degien). In these exposed places the lobelias are stunted ; none showed any sign of flowering. The gigantic flowering examples, reaching (with their inflorescences) over 20 feet high, were in sheltered valleys and clefts, usually a little lower down—from about 11,000 feet upwards. After flowering the plants die.

The track up the western valley bends to the north a little short of the summit of Buahit (14,796 feet), so the caravan (ahead of me) turned to the left and seemed to disappear into space over the edge of the main escarpment. The path leads, in fact, round the northern shoulder of the peak, by a narrow rock-shelf at the top of the precipice, over rocks polished by the feet of generations of men and pack animals. Our own beasts tried to scatter in all directions, until persuaded to face this dizzy passage. I needed all the help offered, for a slip to the left would have meant a fall of hundreds of feet at the least.

[79] Pichi-Sermolli (1940) calculated the altitude of Cennech (Chennec) as 3714 metres (12,186 feet).

Beyond this difficult place the track descends the steep north-eastern spurs of Buahit to the ' saddle ' or col at Arcuasié (somewhat above 12,000 feet), whence it turns north-westwards and descends again to about 11,500 feet at Lori.

Lori stands on a gently sloping promontory (Plate 13), projecting westward from the main escarpment between two deep ravines, and backed to the east and south by a splendid amphitheatre of mountains. Almost due east rise the more gentle outlines of Mt. Beroc-Waha[80] connected by the broad saddle of Arcuasié with the frowning northern precipice of Buahit (over which we had travelled). Between the deep ravines, tributaries of the Anzia valley, ridges extending north-westward are broken into rock towers, *pitons* and *aiguilles* of striking form.

On the undulating ground, more suitable for entomological collecting than the rocky, uneven sites of previous camps, I stayed a week, camped on a rolling expanse of grass, beyond which lay fields of barley, not yet reaped. Just to the north stood the thatched church of Kidana Mihrat,[81] in a grove of trees surrounded by a dry stone wall. This church stands solitary between two little clusters of tukuls, both some distance from it, but both reckoned as parts of Lori.

A spell of thunder and hailstorms burst suddenly at Lori. The local peasants, working hard at their barley harvest, evidently expected no interruption at this season. My retainers, feeling equally secure, had dug no trench on the slope above our camp. Consequently when, after a sunless day, a furious hailstorm broke on the evening of 29 November, the hail struck ground warm enough to melt it even at that altitude, and icy water rushed through our tents. Fortunately my mule trunks were raised on stones, and specimens and apparatus were on the table, so nothing was harmed. But the men spent much of next day drying their belongings in the sun.

A short lull followed the flooding, then a violent thunderstorm began again, continuing for hours, with no interval between the flashes of lighting and peals of thunder, an experience the more unpleasant from the solitary position of our tents. Later in the night the storm centre moved, but thunder still rumbled in the distance, mingled in the small hours with sounds of a drum and singing ; for the clergy and singers of the church about 100 yards away were beginning their Sunday service before dawn, undeterred by the weather (30 November).

Daylight showed Mts. Beroc-Waha and Buahit powdered with frozen hail. This lay for some days, while fresh falls of hail whitened the highest summits intermittently till late in December.

Notwithstanding the weather, the stay at Lori was entomologically profitable. Phalacridae and other flower-haunting beetles were collected from a shrubby *Senecio* (*S. myriocephalus*) in the grove round the church. Specimens of several of the new *Calathus* were obtained; in the case of the most plentiful, *C. simienensis*, 87 (out of a total 269) were collected there, 25 of them from under the loose, dry bark of a felled *kosso*-tree (*Hagenia abyssinica*) in the church grove. Two specimens of an Embiid[82] were found in a crevice of this bark, also many pupae from which, despite jolting on the journey, a series of a Noctuid moth afterwards emerged.

A gummy, yellow-flowered scrophulariaceous plant (*Bartsia longiflora*), plentiful on the lowest part of the steep slopes east of the promontory, yielded

[80] ' Stream of ice ', according to Hövermann, 1954, p. 112.

[81] Kidana Mihrat, literally ' Covenant of Mercy ', refers to a cult of St. Mary the Virgin peculiar to the Coptic Church. The dedication is not uncommon.

[82] The few other Embioptera, about 16 specimens altogether, collected at high altitudes both in Simien and the Gughé Highlands, were nearly all taken from dead stems of *Lobelia rhynchopetalum* (see below, p. 73).

various small Diptera and Chalcid Hymenoptera when shaken over a net. Higher up the slopes many young lobelias repaid investigation, the results of which are given below (p. 73).

Across the Mai Shāha Valley to Degien (3–12 *December*)

The site of the weekly market at Arcuasié, a bare, trampled space without buildings, at over 12,000 feet, must be one of the highest market places in Simien, or indeed anywhere in Ethiopia. Beyond it the track led eastward, up and down, in and out among the mountain spurs, to Atgheba Ghiyorghis, above the steep west slope of the Mai Shāha valley, with a full view of the massif of Degien (Plate 14).

(The highest settlement in Simien, and possibly in all Ethiopia, is the small village of Addi Bado at 3920 metres, or 12,861 feet, on the east side of the Mai Shāha, south of Degien ; according to Nilsson, 1940, p. 62.)

Not far from Arcuasié the valley of a tributary stream, the Mai Datcha, its sides clothed with tufted grasses and sedges, groups of *Lobelia rhynchopetalum* (not flowering) and *Erica arborea*, was one of my highest collecting-places.[83] Returning there for some hours on 5 December I took (among other insects) 163 specimens of a new Carabid (*Omotaphus simienensis*) from beneath the radical leaves of *Landtia rueppellii*, a Composite abundant round a marshy pool in the broad sloping floor of the valley, each plant raising an almost sessile yellow flower-head from its rosette of leaves.

A small rodent in warrens. A rodent between a mouse and a rat in size, with long muzzle and long tail, was plentiful at and near Mai Datcha. These animals, whose burrows were in little groups or warrens, opening near water, were active by day, scuttling to their holes when approached. Although, without specimens, their identity is conjectural, they closely resembled the figure given by Osgood (1928) of his *Nilopegamys plumbeus*, discovered near the Little Abbai River. Some small Coleoptera were collected from litter in the mouths of their burrows, but no search for commensal insects by excavation of the rodents' nests was possible (see postscript, p. 90).

Atgheba Ghiyorghis, where camp was pitched during a heavy rainstorm in the afternoon of 3 December, is situated at about 10,900 feet, above the steep west side of the vast *cirque* formed by the upper part of the Mai Shāha and its tributaries. The surrounding land is almost all arable ; but, as Dr. Nilsson has written (1940, p. 59), the whole surface of the valley is so dissected by ravines into sharp ridges, that the inhabitants can scarcely find level spaces large enough for the threshing-floors where their teams of oxen tread out the grain.

However, the farmers were busily reaping, principally barley, but also a few whole fields of oats,[84] a cereal which I had hitherto only seen in Ethiopia growing scattered in the barley fields. Their tukuls were situated singly, the only approach to gardens being small patches of ordinary yellow-flowered mustard (*Brassica nigra*, in Amharic *sanafitch*), enclosed by fences of brushwood, adjoining the houses. A field weed common here, but not met with elsewhere on my journey was *Salvia schimperi*, a strong-smelling wild sage, with grey foliage, and blue-edged white flowers.[85]

[83] The Mai Datcha valley is, as nearly as I could estimate, at about 13,200 feet. It lies even higher than the pass at Arcuasié, for the track which we followed mounts higher on the mountain side, east of the pass, before descending towards Atgheba Ghiyorghis.

[84] Ghidello called oats 'kirdad', short for *inkirdad*, an Amharic word also used for certain grasses (*Lolium* sp.) ; the word for oats is more properly *sinar*.

[85] See my article, 1955, p. 438. This plant had been cultivated in England long ago, a figure having been published in 1877. I grew it from seed easily in the two years following my return.

Abundance of choughs (*Coracia pyrrhocorax*). These birds, in a flock amounting to hundreds, after great clamour descended on the grain fields on two successive days. I had seen a small flock, perhaps 20–30, only a mile or so east of Debārec on 15 November, and another flock, probably larger, on the Ambaras ridge on 20 November; while a pair, apart from any flock, was twice seen on some crags above Lori (28 November and 3 December). These observations, suggesting that choughs are more numerous among the highest peaks, are recorded as an indication of the numbers of this species in Simien, and on account of the special interest attaching to its presence in northern Ethiopia as a whole (*antea*, p. 16; compare Dr. Bailey's observations, 1932, pp. 72–3).

The noisy cries of these birds, and their flight, recalled Shakespeare's description in *A Midsummer Night's Dream* (Act 3, Scene 2) of how a flock of choughs, startled by the report of a gun, 'rising and cawing . . . madly sweep the sky.' His vivid phrases may apply equally to other gregarious Corvidae.

Crossing the Mai Shāha Valley. On 8 December the trek from Atgheba Ghiyorghis to a point on the east side of the Mai Shāha, south-east of the twin villages of Mecāna and Abbo, involved a descent of nearly 1600 feet to the ford lying at about 9300 feet, and a climb up the eastern slopes to about 10,500 feet.

The descent, which had to be made entirely on foot, consisted of about 600 feet of very steep, rock-strewn grassy slopes, followed by a scramble down nearly 1000 feet of extremely steep canyon side, the lower part over gritty rock different from the basaltic lavas. If in 1922 Maydon had found the descent into the Mai Shāha Valley 'very bad for mules',[86] in 1952 I found it rough going for both animals and men.

The lower stretches of the path led abruptly down through a belt of aloes, the red flowers of which were nearly over, into a belt of euphorbias of candelabra type, on the gritty rock. Viewed from the eastern side of the valley, how regular appears the line formed by the upper limit of these euphorbias; probably of an undescribed species, standing little more than the height of a man, and growing at an altitude considerably above the limit of the huge candelabra-trees (*Euphorbia candelabrum*).

The camp near Mecāna and Abbo was situated in a valley, in a terraced, stony field, near which tall, prickly-leaved, giant globe-thistles (probably *Echinops hoffmanianus*) stood about six feet high, in thickets. These plants, perhaps one of the species figuring in old drawings of Simien, still had a few white flowers on their great, buff-coloured, globular heads.

The valley, narrow and precipitous-sided, was much more sheltered than the exposed site at Atgheba Ghiyorghis but, like the ravine at Arghine, it resounded at times with the shouts and 'coo-ees' of goatherd boys.

Ascent to the Pass of Degien. Though the stay near Mecāna-Abbo (8–13 December) gave opportunities for collecting insects near at hand, my main purpose, to ascend the Degien massif as near as possible to the highest summit, Ras Degien itself, was carried out on 11 December. I then attained a point well above 14,000 feet, just below the 'Pass of Degien'. Time and distance, rather than any topographical obstacle, precluded reaching the highest summit. From my camp to the Pass appeared on the map only between three and four miles; but the steep descents and ascents needed to cross ravines, and unnumbered windings round spurs of the mountain, made it much longer. When I could ride my mule no farther on the talus-slopes, walking at that altitude was slow work.

Ras Degien has been described as a steep-sided rock remaining between two cirques and the main eastern escarpment of the Mai Shāha Valley (Nilsson, 1940, p. 62). The track to the Pass leads to one of these cirques, facing north-west.

[86] See Maydon, 1925, sketch-map on p. 116.

At the highest levels the association of plants already seen on Mt. Buahit holds sway, the principal components being again the spiny 'everlasting' (*Helichrysum citrispinum*) and innumerable stunted lobelias, the latter not in flower. Viewed through field-glasses, the mixture of these two plants appeared to extend almost to the top of the precipitous escarpment of Mt. Ualta[87] (Plate 15). Above this only bare rock could be discerned.

Below the Pass, however, a plant not previously seen covered an expanse of some square yards, namely a herbaceous *Senecio* (*S. farinaceus*) about as tall as ragwort. From this I swept a few insects, small Diptera and Hemiptera, and more than one species of thrips (Thysanoptera). Otherwise little was obtained beyond shiny black weevils (Curculionidae), and a cluster of nearly black snails, a melanic form of the Vitrinid *Phenacolimax riepiana* (mentioned above, p. 17).

Under the prevailing conditions it is not surprising that little was found. Though the direct sunshine was hot, small cascades on the torrents descending from the precipice were frozen; the soil was dry. No butterflies were on the wing, and the only birds seen were a few large birds of prey. Domestic animals grazing below were unguarded, a fact taken by Ghidello to indicate that hyænas were probably absent.

In my *reconnaissance* of the highest mountains all had now been done that was possible in the time and compatible with intensive search for small insects. In the highest zones of vegetation I had visited Mt. Buahit, Lori and the heights above it, the *col* at Arcuasié and the north-western aspect of Degien. Needless to say, much remains to search for on these mountains, while I had perforce to omit the northern summits, Beroc-Waha, Selki and Abba Jared. But my way now led south.

The Mai Shāha Valley and ascent again to the western plateau (13–17 *December*)

Having re-crossed the torrent to its right (west) bank, some way south of the ford used on 8 December, the track mounted gradually to Bahr Amba Abbo, a village at about 9600 feet, the centre of a subdistrict called Worqa. On 15 December (a Monday) a small market was held quite near my camp, yet entirely hidden in a rocky hollow.

Terraced fields; primitive houses; large trees preserved round churches. Relating to the distribution of different forms of terracing, it may be noted that some fields in the Mai Shāha Valley are levelled and terraced, though no terraces seen were more than a few feet high, nor had they elaborate stone walling.

Owing to the dearth of timber, the houses at the higher altitudes are very primitive, with rough dry stone walls, and roofs of branches and grass thatch. Large trees usually exist only where preserved in the sacred precincts of churches. At Bahr Amba Abbo the grove round the church consisted of giant junipers (*Juniperus procera*) and wild olive; elsewhere the groves were entirely of juniper.

The dedications of churches may, if noted, help to locate places. That at Bahr Amba Abbo is dedicated to an Ethiopian saint (St. Abbo), round whose name legends have accumulated.

Epidemic diseases (*poliomyelitis* ?). In these remote places a countryman sickening of any disease would probably refuse, in the early stages, to go to the

[87] I give this name because, according to D'Abbadie (1860–73), followed by Pichi-Sermolli (1940), the separate parts of Degien have distinct names. Mt. Ualta (Walta) lies a little west of Mt. Ancua, just south-east of which is the highest point of the whole Degien massif, Ras Degien itself. But my escorting chieftain, Kanyazmach Waratta, when questioned, did not call the summits by different names; he said the whole massif was 'all Degien'. (His home at Ambaras is about 20 miles to the west, but I had no opportunity to ask anyone living nearer to Degien.)

nearest hospital at Gondar, over 60 miles south ; or, should he consent, how could he be moved to the motor-road ? (Local air-transport was not then available.) These reflections were prompted by Kanyazmach Waratta warning us not to visit certain villages owing to the prevalence of a disease which, from Ghidello's description of the symptoms, I presumed to be poliomyelitis.

Insects from trees and flowering shrubs : a day was given to collecting in a tributary valley (considerably lower than the village), where the broad, sloping, grassy floor was crossed by a stream fringed with wild mint (*Mentha* sp.), not in flower (Plate 15). Chrysomelid beetles were swept from this herb, while flowering Solanaceous shrubs (*Discopodium penninervium*), growing in the low dense scrub clothing the sides of the valley, also yielded small beetles when shaken over a net. Other insects were obtained from a low aromatic Labiate shrub (*Becium grandiflorum*) and from the juniper and wild olive trees round the church. These places were enlivened by perky black birds with partly white wings and upturned tails, uttering sharp, penetrating cries. One of them entered a hole in the rocks, and their behaviour altogether indicated nesting (possibly Rüppell's Chat, *Pentholaea melaena*).

A short stage led (16 December) a few miles south down the valley to Zagultā (a name spelt phonetically, not seen on any map). From a low-terraced stubble field on a mountain spur, the camp overlooked the Mai Shāha torrent, and on the far (east) side the mountains shown in Plate 16 (upper photograph). On a neighbouring eminence stood a church dedicated to St. Mary and St. Michael. At this altitude, little above 8000 feet, the vegetation was characteristic of the *wainā dagā* rather than the real *dagā* (highlands). Tall and spreading *quolqual* trees (*Euphorbia candelabrum*), some with yellow flowers, others with scarlet fruits, stood in sheltered lateral ravines.

The following day, farther south down the valley, an even greater change was visible. Many wild olive trees (*Olea chrysophylla*) stand on the mountain slopes, while the lowest ravines contain thickets of small, spiny *agām*-trees (*Carissa edulis*), characteristic of rather dry scrub. Their clusters of small pink flowers have a distinctive perfume ; their fruits are eaten by shepherd boys, and are sold to children in city markets (the name *agām* may also be used for jasmine).

Ascent to the western plateau. That day's trek (17 December), lasting from 9.45 a.m. to 5.15 p.m., though extremely arduous, proved most interesting. Some distance north of the abrupt, elbow-like eastward bend of the Mai Shāha, our path left the main valley, turning west along a tributary valley (Plate 16, lower photograph), whence a long climb led up to the western plateau once more.[88]

A long, steep ascent, rocky and rough, among wild olive trees, led to a very narrow track winding along the wall of a ravine, rising in a series of precipitous gradines. The path was only less dizzy than it might have been, because it lay through a thick forest of small trees, enclosing its outer edge so that those travelling along it could not see into the abyss. These woods again consisted mainly of wild olives, interspersed with tall purple *Vernonia* and other herbaceous plants. But barley was still being harvested on little shelves of soil, or tiny fields at steep angles. Moreover the cultivators, cutting down olive trees and rooting up aloes to clear the path, had left the narrow track cumbered with these plants.

Finally, a hard scramble led up a stony torrent-bed at a very steep angle, the lower part filled with forest trees, among them an occasional giant juniper, and trailing *Clematis simensis*. On some overhanging rocks facing north, down

[88] In *Webbia* (1955) I wrongly wrote ' eastern ' instead of ' western plateau ' in the heading on p. 440, and ' eastern ' instead of ' western ' on p. 441, line 11. I meant to indicate the eastern edge of the western plateau.

which water trickled, a group of *Primula verticillata* still displayed their golden flowers, and a delicate *Swertia* trailed its stems (Plate 17). Still higher, in more open spots, aloes were mixed with tree-heath; but at the top the scarlet aloe flowers gave place to white roses (*Rosa abyssinica*).

On either side of this torrent-bed, great tawny *gelada* monkeys grimaced from shelves of rock close on the left, while children were chasing other geladas from steep barley fields on the right. When previously viewing other clefts in the walls of the Mai Shāha Valley, streaks of green contrasting with vegetation now largely brown and dry, I had thought that, if a man could go up them, these clefts would yield interesting insects. The ascent of one such cleft confirmed this opinion, though it is doubtful if even a younger entomologist could maintain a foothold while collecting specimens.

The southern edge of the plateau, westward to Derasghié (18–25 *December*)

From the head of the torrent just described, the caravan travelled first west of south to Shāha Ghiyorghis, where two nights were passed; thence nearly due west across the southern edge of the high plateau, with a further halt of one night at Mai Abbo, till Derasghié was reached on 20 December.

Between Shāha Ghiyorghis and Derasghié two rivers were forded, the Dorōna, a broad torrent, and the Mai Abbo, a smaller stream. Both flow south to join the Mai Beleghès in its course eastward to the Tacazzé. In this part of the plateau the slopes are less steep, and the ridges broader and more flattened. But travelling over the arable and grassland is still rather fatiguing, owing to the countless boulders lying loose on the surface, even on the tops of the ridges. These boulders only become less at the approach to Derasghié.

The many juniper trees (*Juniperus procera*) on this part of the plateau, at altitudes somewhat below 10,000 feet, are probably relics of former continuous forest. The little thatched church of Shāha Ghiyorghis is surrounded by a grove of splendid junipers (Plate 17), not as lofty as those in dense forests in other parts of Ethiopia, but at least 50–60 feet high, broadly spreading and hung with lichens (*Usnea*). A secondary growth of juniper extends over much of the countryside, consisting of thickets and individual trees, many being no taller than bushes and mingled with bush-*Hypericum*, bush-*Rumex*, giant globe-thistles (*Echinops*) and *Kachamo* bushes (*Myrsine africana*, from which a much-used purgative is made).

Derasghié,[89] where four days (20–24 December) were passed, is a large village, presenting a gentler, pastoral aspect, pleasing after so much wild, grim scenery. My camp lay in a broad flat valley, where on Sunday small boys played *gana* (Ethiopian hockey). Other players, including some of my retinue, joined in, vigorously hitting the unevenly-shaped knot of olive wood which served as a ball.

The village, set on a low ridge, consists of circular tukuls with walls of dry stone and conical thatched roofs, standing in enclosures surrounded by fences of thorny acacia branches or low stone walls. The church of Maryam, of the familiar circular form, with thatched roof forming a flattened cone, is associated with the botanical exploration of the country. It was designed over a century ago by W. G. Schimper, which possibly accounts for its large size and elaborate construction. In February 1855 Ras Oubieh (Ubié) of Tigré, for whom Schimper planned the church, was defeated by his rival Kassa. The latter was crowned there as Theodore II, reigning thereafter over all Ethiopia till 1868.[90]

[89] The name Derasghié is said to be contracted from Debra Egziabher, the Hill of God.
[90] This church contains notable fresco paintings in traditional Ethiopian style.

The immediate precincts of the church are enclosed by a high stone wall, outside which are fine groves of juniper trees, growing closer and taller than those at Shāha Ghiyorghis. Some junipers, standing alone, have been so polled as to resemble roadside elms in outline. There is an admixture of trees such as flat-topped acacias, characteristic of lower altitudes. Among herbaceous plants not seen before, a tall wild kale (*Crambe hispanica*) may be instanced as a Mediterranean species.

Numerous caterpillars (Geometridae and others) were obtained by beating the lower branches of juniper trees and other foliage; unexpectedly at this season of dry weather, with some frosty nights (e.g. 21–22 December), though distant thunder recurred and the far-away mass of Degien was again whitened with hail. The foliage and little green flowers (just opening) of a small tree called *atāt* (*Gymnosporia* sp.) also attracted many insects.

A cave containing a church. On 23 December I visited an extensive cavern under a great overhanging mass of twisted columnar basalt, near the top of a lofty precipice some miles west of Derasghié. It is reached by a long zigzagging descent more suited to the local people and their goats than to a European traveller. In the Rains a waterfall spouts from the overhanging edge of the cliff above, falling across the mouth of the cave, but in December the watercourse was dry. The cave has a nearly flat floor of gritty earth.

At this season the only insects collected in the cave were some moths, *Hypena obsitalis*, a species widely distributed in northern Africa, southern Europe and elsewhere (rarely found even in Britain), and probably another species of *Hypena*; also some large Dolichopodid flies frequenting a damp part of the rock-walls (these are male specimens of a new *Liancalus*, fairly closely resembling the European *L. virens*). Neither the moths nor the fly are strictly cave-dwelling insects (I had previously collected specimens of *Hypena obsitalis* in Jem-Jem Forest, west of Addis Ababa, in 1926.) Specialized cavernicolous insects, not hitherto recorded from Ethiopia, so far as I know, would be better sought in limestone districts than in volcanic rock.

The cavern is enclosed and partitioned by rough stone walls without sculpture, thus forming a church, now only occasionally used. Though described as ' the monolithic church of St. Gabriel ' (*Guida*, p. 257), it is not a rock-hewn edifice like those for which northern Ethiopia is famous. But besides a broad ante-chamber, walled in but lighted by unglazed windows and having a wooden door, it has a chapel with an inner door on the left (not shown to us), and on the right a low-roofed prolongation of the cave, where lie some 15 mummified human bodies of both sexes, of uncertain date and origin;[91] some, in an inner and progressively lower part of the cavern, were wrapped in ordinary palm-leaf matting, apparently recently renewed. An old Coptic priest, who guided us from Derasghié, gave Ghidello the name of the church, not as St. Gabriel, but Abba Hān Sadkhan Washa,[92] adding that the persons whose mummified bodies lie there all died on St. Gabriel's Day.

Beyond the opening of the cavern, our priest-guide led those who could face such a path, by a very narrow shelf of rock overlooking a tremendous abyss, to a cemetery chamber in the rock, containing human skulls and bones. Even Ghidello could not face this vertiginous path, exclaiming that his head turned when he looked downwards.

[91] Since I saw these mummies in December 1952, fragments of their clothing have been taken by more recent travellers for testing as to their age, but I am not aware that any result has yet been published.

[92] *Washa* is Amharic for ' cave ' and *abba* is the designation of a priest, so the name of the church is apparently ' Cave of Father Hān Sadkhan '; but the personal names were written down phonetically, and their correct form is uncertain.

RETURN TO DEBĀREC ACROSS THE MAI BELEGHÈS (25–30 *December*)

Wishing to re-examine the first giant lobelias seen, after an interval of nearly six weeks, I rejoined my outward route near Mindigabsa. This meant crossing the vast chasm of the upper Mai Beleghès, separating the narrow north-western ridge of Ambaras from the main western plateau—involving a descent and an ascent each of over 2000 feet, covered in three days, two long rides with a short one between.

On 25 December, from 10.30 a.m. till nearly 6 p.m., the way first led west of north across the plateau, over rolling country. To the right (north-east) lay a wide view of the gentler slopes of Buahit and other peaks, about 20 miles away, their northern precipices being hidden from view. Beside the track, some distance apart, lay two heaps of stones, to each of which pious wayfarers add a stone, for the heaps point the direction where two churches are visible some miles away. Similar wayside heaps of stones occur in southern Ethopia (my paper; 1952, p. 174, pl. 17).

After crossing a moderately deep tributary valley, the track rose again to a shoulder of the plateau, where a cluster of *tukuls* was pointed out as Enchetcab, formerly the residence of the chief ruling Simien (see above, p. 56). Thence a long, rough descent led to a deep tributary valley of the Mai Beleghès, where camp was pitched. On the way we met with the only snake seen during six weeks in the mountains.

Next day a short ride led to a camping place in the main Mai Beleghès valley, at about 7500 feet, more than 2000 feet lower than Derasghié. In a wide, flat part of the valley, a few old willow trees (*Salix subserrata*), lofty and spreading, with very thick trunks, contrasted with great candelabra-euphorbias, covered with scarlet fruits. Several other plants met with, but not previously seen, are noted in *Webbia* (1955, p. 444).

A spider living in communities. At one place in this valley (about 7500 feet) enormous, spreading, communal webs of a large spider covered a thicket of bushes so densely as to resemble white smoke at a short distance. According to Dr. L. Berland these spiders may have been a species of *Stegodyphus* (family Eresidae), a genus not previously known so far north in eastern Africa.

Phonolites. A little thatched church nearby had phonolites or ' clinkstones' , flat slabs of local rock which ring when struck, suspended from a tree by wires. Probably phonolites were more widely used, but are now largely replaced by bells.

Ascent to the ridge of Ambaras and return to Debārec. The ascent on 27 December, over 2000 feet from the valley to the north-western ridge, was less arduous than that from the Mai Shāha to the western plateau on 17 December. Yet on the boulder-strewn paths up the precipice I had at intervals to dismount and climb steep irregular ' staircases ', hollowed and polished by the feet of men and the hooves of pack animals out of the harder layers of volcanic rock, which in profile project as gradines.

This west wall of the Mai Beleghès valley appeared drier and more thinly wooded. Large expanses were covered with brown, dry grass, among which grew scabious (*Scabiosa* sp.), pink rather than mauve. At one spot a strange-looking Labiate, *Plectranthus defoliatus*, raised its bare stems above the dry grass, displaying its rich deep blue flowers projecting horizontally like beaks. Other plants found only there have been recorded (1955, p. 444).

Our last camp was pitched where giant lobelias were first encountered on 17 November, and two days were spent in entomological work. On 28 and 29 December the mornings were bitterly cold ; hoar frost lay thick on the grass, and the ice in a canvas basin was nearly $\frac{1}{4}$-inch thick. On 30 December I returned to Debārec. Men, mules and horses straggled back, till all were assembled at the place whence we had set out on 15 November.

After the caravan journey : Debārec to Gondar and Lake Tana (3–19 *January* 1953)

To cover the 64 miles to Gondar occupied nearly two days, 3 and 4 January, as parts of the road were under repair. I had fortunately found a lorry for hire at Debārec.

The town of Dabāt, some 15 miles south of Debārec, lies about 1000 feet lower (*c.* 8860 feet). Between the two places the not very interesting Woghera plateau consists, at first, of rolling hills with *tid*-trees (*Juniperus*), isolated or in groves round churches. Farther south and lower, the even barer countryside is of grassland and arable, almost the only trees being scattered acacias, gnarled and polled. But any monotony on the plateau is amply compensated by occasional views of volcanic scenery from the edge of its precipitous western escarpment (Plate 5, lower photograph).

On the hills round Dabāt, particularly south of the town, stand large quadrangular buildings, taken at first to be former military posts, but really high-walled enclosures intended for colonists during the Italian occupation. Most were unroofed and ruined, but one crowning a hill north of Dabāt is maintained by the Mission to the Falashas ; its compound has four houses all alike, originally for four families, in its corners.

A stay at this hospitable Mission on the return journey made possible an excursion to the south, descending to about 7000 feet. At one point the soil was packed close with large reddish bulbs. Many had been torn up and scattered, presumably by *geladas*, as the meaning of the Amharic name, ' monkeys' onions ', denotes ; the plant (called ' *Amaryllis vittata* ', *Guida*, p. 252) is probably a *Crinum*. Though on 21 January nearly every spot was dry, Dabāt should be a good centre for collecting during the Rains, when trekking in the mountains is difficult. My hosts spoke of ' whole fields ' then blue with *Myosotis*, besides the handsome white, violet-striped *Crinum*.

South of Dabāt the country, more hilly but with rounded contours, is still highly cultivated ; many crops were then green, principally barley already in ear. But houses and villages are far apart. The road rises again in 21 miles to country exceeding 10,000 feet at Amba Ghiyorghis (where we camped). Along the last 28 miles to Gondar, patches of attractive-looking mixed forest were bright with the compact golden-yellow inflorescences of *Lasiosiphon glaucus*, a showy but unpleasant-smelling small tree (seen in 1926 on Mt. Chillālo). Its flowers, and those of bush-*Hypericum* at higher altitudes, contributed to the prevalent yellow among the few wild flowers still blooming in January.

The stay at Gondar (4–19 January)—which seemed very hot after the climate of the mountains—included a further journey of some 40 miles south to Gorgora, on the north shore of Lake Tana (14–16 January). This was cut short by the illness of the driver of the only available vehicle, necessitating immediate return to Gondar for hospital treatment. But a few insects collected in a lake-side marsh (6000 feet), and others taken in Gondar itself (mentioned above, pp. 26–28), naturally represent a faunistic association very different from that of the high mountains. The birds frequenting the city and its outskirts were also different, including a very small sunbird[93] with flashing emerald-green on the head, a strikingly coloured bee-eater, and glossy starlings with rosy breasts (*Spreo* sp.).

The lack, at the present day, of plantations of *enset-trees* (*Ensete edulis*) in northern Ethiopia has been mentioned ; only a few trees in gardens were seen, at the Falasha Mission and in Gondar. A minor crop noted between Gondar and Gorgora was *nūg* (*Guizotia abyssinica*, rantil or niger seed), grown for its oil-bearing seed. Its golden-yellow flower-heads contrast with the orange-coloured flower-heads of the safflower, yielding a dye (*Carthamus*

[93] Probably *Cinnyris venustus fazloqensis*, the Variable Yellow-bellied Sunbird.

tinctorius, in Amharic *sūf*, a name also used for sunflower). In Ethiopia both these widely distributed eastern crops are grown, usually between 6000 and 7000 feet.

(Should any reader be interested in the impressive royal castles and other buildings constructed in the 17th and 18th centuries under the influence of the Jesuit Mission, some now in ruins, others repaired for modern uses, a full illustrated account, with plans and diagrammatic reconstructions is given in *I castelli di Gondar* by A. A. Monti della Corte ; Rome, 1938. These remains of former splendour proved even more impressive in reality than I, judging from illustrations in books, had expected.)

D. Lobelia rhynchopetalum, its associated animals, etc.

Observations on this striking plant, so abundant in several places described in the foregoing narrative, are here summarized.

As stated above (p. 32), only two species of giant lobelia are found in Ethiopia. One, *Lobelia giberroa*, widely distributed in other parts of eastern Africa, occurs in several parts of central and southern Ethiopia, at altitudes between 9000 and 10,000 feet ; in some places it is seen in cultivated land, near houses. But in Simien it is not found at high altitudes where my route lay, and I saw only one specimen (not flowering), on my return journey down the great northern escarpment (see postscript p. 91).

Lobelia rhynchopetalum, on the other hand, is confined to Ethiopia, but not found much below 11,000 feet, though its range extends upwards to over 14,000 feet (on Degien to almost 15,000 feet).

One of the most striking plants in Ethiopia, it is remarkable, even among the giant lobelias of the African mountains, for its bare woody stem or trunk. The tallest specimens reach a height of well over 20 feet when in flower, allowing eight feet or more for the bare stem, about six feet for the crown of drooping sharp-pointed leaves and at least eight feet for the long, lofty inflorescence. The bluish-green (eau-de-Nil) colour of the inflorescence, noted by earlier travellers, is entirely due to the bracts, among which the flowers are quite hidden. The flowers themselves are partly purple and partly blue. After flowering and fruiting, the plant dies.

I met with *Lobelia rhynchopetalum*, not in flower, on the summit of Mt. Chillālo in 1926 ; and again in small numbers, in 1948, on several high points in the Gughé Highlands, in exposed situations, usually on the almost inaccessible edges of precipitous escarpments (see my previous paper, 1952, p. 150 and pl. 18).

In Simien, the plant is extremely plentiful locally. It attains gigantic proportions in sheltered ravines running back from the edge of the northern escarpment ; in such places many young plants are also found, not yet flowering, from two or three up to about nine feet high. But besides those growing in sheltered spots, hundreds of stunted-looking specimens, from about three to six feet high, cover the exposed highest slopes on Buahit[94] and Degien (compare photographs on Plates 11 and 15). I cannot say whether many flower in such bleak situations.

Vernacular names ; uses. The name is transliterated *gibarra* or *gevara*. It is probably loosely used for other plants of a like habit of growth, as I heard it applied to a *Dracaena* tree in southern Ethiopia (at Sōddu, Walāmo Province).

Apparently no use is made of the plant, except that the hollow woody stems of those which have died after flowering serve as long trumpets for shep-

[94] In the old drawings edited by Sophie Veitch (1868), examples of *Lobelia rhynchopetalum* in flower are seen in the foreground of three views, nos. 10, 22 and 26, all of which show Mt. Buahit in the background.

herd boys. I have not seen boys engaged in this pastime, but one of my men demonstrated the practice by trumpeting through a stem (Plate 13). The dead trunks, consisting only of thin bark and a little fibre, are almost useless for fuel.

Folk-lore. Powell-Cotton (1902, p. 358) stated that priests in Simien wrote charms against the evil eye with the sticky fluid exuding from the stem or leaves of the plant when cut. Also that the local people believed each lobelia to be the abode of an evil spirit cast out of a human being. He discovered this through their displeasure when he slashed off the head of a lobelia obstructing his photographic work. They feared that the spirit thus released might again possess some person.

I heard of no such ideas, nor (so far as I knew) was any objection raised to my cutting down a few lobelias in order to search them for insects. (In southern Ethiopia, however, some such fears may induce the inhabitants to conserve the other Ethiopian species, *Lobelia giberroa*, when they clear wild vegetation from their land; this 'deliberate conservation' of the plant was mentioned in my previous paper, 1952, p. 148.)

Lists of animals associated with Lobelia rhynchopetalum:

Birds: only one instance is recorded. Otherwise my observations had negative results, mentioned first below.

(*a*) *Sunbirds* (*Nectarinia*). These have been seen occasionally rifling the inflorescences of lobelias in the Ruwenzori range; for instance, a figure of *Nectarinia johnstoni* subsp. *dartmouthi* on a lobelia-inflorescence, based on a photograph by Chapin, is given by Jeannel (1950, p. 235). But I have never seen sunbirds so occupied in Ethiopia, though sometimes the birds were close at hand; e.g., at Arghine (23–24.xi.1952) a pair of the Tacazzé Sunbird (*Nectarinia tacazze*) were interested in a nest hanging from tree-heath only a few yards from the tallest flowering lobelias which, as far as I saw, they did not visit.

(*b*) I watched what was apparently a wood-hoopoe at a distance of a few feet, at Arcuasié, about 12,000 feet (3.xii.1952). The bird clung to the inflorescence, into which it was pushing its bill, while pressing its outspread tail against the lobelia (as a woodpecker does on a tree trunk); it then flew off, uttering a single shrill cry. In its size, curved bill, black colouring, and the white spots on the tail, the bird nearly resembled the Black Wood-Hoopoe (*Scoptelus aterrimus notatus*), of which the British Museum has examples from Senafé, little more than 100 miles north-east of Simien, but several thousand feet lower than Arcuasié. Exact identification of the species is impossible, but my observations are recorded in the hope that they may be confirmed by future observers.

Apparently birds visit these plants too rarely to be regular agents in pollination. I have recently (May, 1958) heard from a surviving member of Dr. Osgood's party, Dr. Alfred M. Bailey (now Director of the Denver Museum of Natural History), that he does not remember any birds visiting flowers of giant lobelias. Dr. Bailey does not recall many giant lobelias flowering in Simien during his visit (ii–iv. 1927), though one of his photographs (1932, p. 65) shows that some were in bloom.

Insects: the following list includes species taken from this lobelia on Mt. Chillālo in 1926, and in the Gughé Highlands in 1948, as well as those from Simien. The insects cannot be enumerated merely in tables, as different ecological notes are added in nearly every case.

Lepidoptera: (1) *Noctuidae, sp. indet.*; distinctively marked caterpillars in all stages were found in fruiting inflorescences of *L. rhynchopetalum* on Mt. Tola, Gughé Highlands, 15.xii.1948 (other caterpillars, apparently of identical species but less numerous, were collected from inflorescences of *Lobelia giberroa* at a slightly less altitude on the preceding day). Attempts to rear the adult moth failed. In

Simien, similar caterpillars, but only partly grown, were numerous in inflorescences at Arghine, November 1952; specimens were preserved, but I could not rear the adults while trekking.

(2) *Noctuidae, Mimleucania* sp.; a single distinctively marked adult moth was taken from a fruiting inflorescence near Mindigabsa, 29.xii.1952; possibly of the same species as the caterpillars, or only a chance visitor, of another species.

(3) *Geometridae, Epigynopteryx* sp. n.; a single male taken on foliage of a young lobelia, 28.xi.1952; presumably a chance visitor. (Descriptions of this and the foregoing species, by D. S. Fletcher, will shortly appear in *The Entomologist*.)

Diptera: (1) Apterous *Sphaeroceridae*; all the specimens of *Binorbitalia triseta* were taken from dead and rotting stems of lobelia. But the south Ethiopian *Binorbitalia discontinua* has not so far been found associated with lobelias; the unique specimen was in humus in a patch of forest.

(2) *Chloropidae, Thaumatomyia secunda*; the congregating of immense numbers in the inflorescences, and their melanic coloration, have been described above (p. 25).

(3) *Syrphidae* (probably *Syrphus*) *sp. indet.*; numerous green larvae were crawling between the separate seed-capsules of a ripening inflorescence near Mindigabsa, 29.xii.1952. Some, accidentally placed with parts of an inflorescence in botanical drying papers, pupated, but the emerging adults escaped during the return journey. The presence of these Syrphids is unexplained, as no Aphids were seen, nor any small larvae on which Syrphid larvae might have fed.

(4) *Drosophilidae sp.*: a series of adults, with larvae and puparia, were found in 'wet decay' in a dead lobelia stem on the summit of Mt. Chillālo, 21.xi.1926. This Drosophilid, believed new to science, was not found elsewhere. So far as I know, it has never been described (the adult specimens were removed from the main Abyssinian collection in the British Museum and have not been traced).

Hymenoptera: as mentioned on p. 24 two wasps, *Polistes marginalis* and *Belonogaster junceus*, both fairly numerous, were regularly visiting the lobelias, apparently for the moisture between the bases of the leaves.

Embioptera: (*a*) in Simien, four examples were taken from dead stems of the lobelia above Lori, at 12,000 feet, 28.xi.1952; wingless and possibly immature, they may be conspecific with other wingless specimens, found beneath bark of a *kosso*-tree (*Hagenia*) at Lori. (*b*) In southern Ethiopia, several wingless specimens were taken from a dying lobelia stem on Mt. Gughé, 22.xii.1948. Whether these Embiids represent one or more species is not yet known.

Coleoptera: (1) Carabidae (excluding Trechinae): in the Gughé Highlands, most specimens of two species of *Calathus* (*C. scottianus* and *C. gugheensis*) were beaten from fruiting inflorescences of *Lobelia rhynchopetalum*, but smaller numbers of both were found in peat-soil under bushes.

In Simien three species of *Calathus* were found to some extent associated with the lobelia. A few examples of *C. nitidus* and *C. ras* were taken from soil at the base of dead stems, but others were found apart from lobelias. In the abundant *C. simienensis*, 17 specimens out of 269 were associated with the lobelia, 16 of these being from either the crown of leaves or the inflorescence.

Therefore, while some *Calathus* (endemic to their massifs, so far as known) seem to prefer harbouring in parts of the lobelia plants, they are not exclusively lobelicolous.

In the latter of Basilewsky's papers cited (1957), single examples among long series of *Omotaphus simienensis* and of *Peryphus scottustulatus* are recorded from soil at the base of lobelia stems—evidently chance occurrences.

Carabidae, Trechinae: in three of the new species of *Trechus* (namely *T. simienensis*, *T. buahitensis* and *T. degienensis*), specimens were found either in dead lobelia stems or in soil at the base of living plants. In the first two, numerous examples were thus associated with the lobelia, but some were also found at the roots of other plants; in the third, the unique example was in soil at the base of a lobelia.

Staphylinidae: in Simien, many specimens of *Xylostiba scotti* were found in moisture between the bases of the leaves, 17.xi.1952; others in inflorescences, 29.xi.1952; many also in dead stems or in soil at the base; but yet others apart from lobelias.

In southern Ethiopia, three examples of *Xylostiba abyssinica* were found under bark of a lobelia stem on Mt. Chillālo, xi.1926, but other specimens had been collected in October in forest on Mt. Zuquāla, apart from lobelias. I rediscovered *X. abyssinica* on Mt. Gughé in December 1948, again associated with the lobelia.

Xylostiba shows a preference for lobelias. Besides the two species mentioned above, respectively in northern and southern Ethiopia, others are associated with the giant lobelias of the east and central African mountains. Probably the association is in no case exclusive. (*Xylostiba* is closely related to *Omalium*.[95])

One specimen of *Anotylus scotti* was found in moisture between leaf-bases of a lobelia, but more than 20 specimens in other habitats, principally roots of tufts of grass.

Three other Staphylinidae were listed by me (1935) from under bark of dead lobelia stems on Mt. Chillālo, 1926: *Megarthrus abessinus*, *Atheta lobeliae* and *Atheta paludosa*, all described by Bernhauer in 1931; but *Atheta lobeliae* was the only one not found in other habitats.

NITIDULIDAE: Dr. A. M. Easton wrote (letter, 8.xii.1955) that four out of a total 45 specimens of *Meligethes* were taken from *Lobelia rhynchopetalum* in Simien. These four examples represent three species.

CRYPTOPHAGIDAE: in 1935 I described *Mnionomus rhynchopetali* and *Atomaria chillaloensis*, both from specimens found (1926) under bark of dead stems on Mt. Chillālo. Probably neither species is associated exclusively with the lobelia (I am not aware of either species having been rediscovered elsewhere).

On my later journeys I have found few Cryptophagidae associated with *L. rhynchopetalum*, but in the Gughé Highlands many were collected from fruiting inflorescences of the other species, *L. giberroa*, at a slightly lower altitude, together with many specimens of the Scolytid *Thamnurgus*—possibly *T. zukwalae*, discovered in inflorescences of *L. giberroa* on Mt. Zuquāla in 1926 (see Scott, 1935, pp. 241, 282).

Probably many Cryptophagidae collected from the lobelias of the East African mountains will be found among material still undetermined at the British Museum.

CURCULIONIDAE: *Pseudomesites gughensis*, described by Sir Guy Marshall (1954), was based on three examples collected from a fruiting inflorescence of *L. rhynchopetalum* on Mt. Gughé, xii.1948, but a fourth specimen was found among decaying stems and leaves of *Kniphofia* near by.

ARACHNIDA, OPILIONES: two examples of *Cristina armata* were obtained in peat-soil at the base of *Lobelia rhynchopetalum* in Simien, but other specimens were found apart from the lobelia, both in Simien and in southern Ethiopia; *Cristina armata* has a wide range, including Ethiopia, eastern Africa and the Congo.

On the other hand, the monotypic new genus and species, *Simienatus scotti*, hitherto known only from Simien, was not found associated with the lobelia, but in the roots of plants at the edge of streams—though at equally high altitudes, and in some cases only a very short distance from lobelias; possibly a slight difference between the ecological requirements of *Simienatus* and *Cristina* exists.

SUMMARY OF LIST, AND REMARKS: the above list of animals associated with *Lobelia rhynchopetalum* amounts to 34 species, comprising one bird (a wood-hoopoe), one arachnid and 32 insects. The insects represent five orders, 23 being Coleoptera, representing five families.[96]

Probably none of the above animals is exclusively associated with the lobelia. Some, for instance the bird and the wasps, are only visitors, occasional or regular. In other species most of the specimens were found in some part of the plant, but a few specimens were also found apart from the lobelias. In yet other species the only specimens known were collected from lobelias.

If we distinguish between *primary* and *secondary biocoenoses*, as defined by

[95] *Xylostiba abyssinica*, described by Tottenham as *Omalium abyssinicum*, was first recorded from Abyssinia in 1931 by Bernhauer, who wrongly referred it to *Omalium algidum* Fauvel.

[96] My list (1935) of Coleoptera associated with giant lobelias *and* arborescent senecios, in Ethiopia and eastern Africa as a whole, included representatives of 13 families.

Paulian & Villiers (1940),[97] it is doubtful if any species is attached to *Lobelia rhynchopetalum* as strictly as certain Coleoptera are attached to succulent euphorbias in Marocco. While these euphorbicolous beetles form a primary biocoenosis, the animals associated with *Lobelia rhynchopetalum* form a secondary biocoenosis, which has originated because the lobelias provide the most suitable—perhaps in some cases the only suitable—environment. Some species, such as the flightless Sphaerocerid, are closely associated with the plant, while others are only temporarily sheltering there, e.g. the species of *Calathus* found in the fruiting inflorescences.

If any of the above insects is associated exclusively with giant lobelias, it may be the Noctuid moth known only from its caterpillars. Even this, as stated, probably feeds on both the species found in Ethiopia.

Pollination : this may be effected by more than one of the animals listed. The visits of birds are too rare for them to be the sole agents. The wasps, so far as I saw, were not interested in the flowers. Flower-haunting beetles may occasionally effect pollination. I surmise (though without proof) that the Noctuid moth may be a frequent agent.

[NOTE.—*Epiphytic cryptogamous plants on Lobelia rhynchopetalum* : according to an Interim Report (Nov. 1957) of the Cambridge Botanical Expedition to Ethiopia, 1957, special attention was given (in the Choké Mts.) to algae, lichens and mosses which, in that order, dominate successive lengths of the bare stem from the top downwards. Details will be awaited with interest.]

APPENDIX 1

SOURCES OF MAPS AND ALTITUDES USED ; NOTES ON LAKE TANA

The following details amplify what is written above on pp. 5–7. The published maps and other sources of information on which my three maps (two folding maps and Fig. 5) are based are as follows :—

Text-fig. 5 (p. 47) : the whole route (by rail from Massawa to Asmara ; by motor vehicles from Asmara to Gondar and Lake Tana, and return ; and by motor from Asmara to Kassala), except the caravan journey in Simien (for which see second folding map) ; traced from International Map, 1 : 2,000,000. North E. 36-37/D. 36–37, 3rd ed., 1943 ; G.S.G.S. 2871. Some modifications were made from the 1 : 1,000,000 North D. 37 (1st ed., reprinted 1945–46 ; G.S.G.S. 2465) ; this latter, the ' Asmara Sheet ', proved to be the most useful map during the journey. The altitudes of mountains were arrived at as explained below ; those of towns are taken partly from the *Guida*.

First folding map (opposite p. 6) : relief-map of most of Ethiopia and Eritrea. Contours traced from parts of two sheets of 1 : 2,000,000, namely North E. 36–37/D.36–37 (including part of D.38, 3rd ed., 1943), and North C.36–37/B.36–37 (5th ed., 1948). Copies of earlier editions of both these sheets (1935 and 1937 respectively) were compared with those mentioned. In inserting various features on the tracing, the 1 : 1,000,000 sheets covering the area were also consulted.

Second folding map (opposite p. 58) : the caravan journey in Simien. A tracing was made from parts of two sheets of the 1 : 500,000 map, namely N.D. 37/4 (Gondar) and N.D. 37/5 (Macallé). Both are dated 1947 and numbered G.S.G.S. 4355, but the contours, differently represented on the two sheets, do not meet at the edges, so that a considerable amount of adaptation was needed. The final drawing was based on an enlarged photograph of the tracing. Altitudes and other details are, however, not taken in all cases from the two published sheets ; some were obtained from the other sources of information mentioned above.

Height of Ras Degien and other peaks. A biogeographical study is less concerned with the absolute heights of mountains than with the approximate

[97] Cited in my previous paper, 1952, p. 103.

heights of the boundaries between the principal belts or zones of vegetation. But reliable estimates of the altitude of peaks are important as ' fixed points ' to which other altitudes can be related.

As stated above (p. 5), the given heights of mountains in northern Ethiopia are on the whole more reliable than those in the south, as they were long ago determined trigonometrically, and the heights have been in the main confirmed in recent years. As possible ' fixed points ', I am chiefly interested in the highest mountain, Ras Degien, and one of the next highest, Buahit ; though I did not quite reach the summit in either case, nor did I attempt to record their altitudes from personal observation.

The first Europeans to estimate the height of Ras Degien were P. V. A. FERRET and J. G. GALINIER, whose visit took place apparently on or about 14 January 1842. Their method was barometric, not trigonometric. They first reckoned the height as 4636 metres (*c.* 15,209 feet), but later adopted a lesser figure, 4623 metres. Neither the exact day nor their procedure are very clear from their narrative (see vol. **2**, pp. 166 and 206, also vol. **3**, pp. 493–494 ; in the latter pages, under the heading *Nivellement Barométrique*, they give 4623 metres for the summit of Degien, ' la plus haute montagne du Samen ').

A few years later A. D'ABBADIE (who visited Simien four times between 1838 and 1848, and whose results were published 1860–73) estimated the height trigonometrically and also, on 15 May 1848, he took a reading of 4713 metres on the summit by boiling-point thermometer. As that figure appeared much too high, he recorded the figure of 4620 metres, through a compromise between the respective figures reached trigonometrically and hypsometrically.

In April, 1937, D'ABBADIE's reckoning was confirmed, within two metres, by PICHI-SERMOLLI and MINUCCI, by the thermo-barometric method (Pichi-Sermolli, 1940, p. 10), and 4620 metres has long been the accepted height.

It could have been hoped that this was ' good enough '. However, WERDECKER, visiting Simien during a journey in 1953–54, made a new survey ' based on a geographical determination of location and a local triangulation net which was observed with a Zeiss theodolite. Altitudes were measured with a Paulin aneroid and the height of Ras Dedgen . . . was thus measured to be 4580 metres ' (1955, English summary, p. 305). Thus WERDECKER's estimate is 40 metres (*c.* 131 feet) lower than that of D'ABBADIE. WERDECKER also reckons Mt. Buahit 40 metres lower than the accepted figure, and several other points lower by varying amounts than they are usually regarded. He supposes that D'ABBADIE may have wished (perhaps unconsciously ?) to make his estimate for Degien agree with that of FERRET and GALINIER. WERDECKER further states (1955, p. 310) that D'ABBADIE made other errors, some of them greater, in reckoning heights.

Not being a surveyor[98] I cannot decide which figures are more nearly correct, those calculated by D'ABBADIE in 1848 and confirmed by PICHI-SERMOLLI and MINUCCI in 1937, or those recorded by WERDECKER in 1953–54. According to WERDECKER, Degien must be taken as about 15,023 instead of 15,154 feet ; Buahit as 14,665 instead of 14,796 feet ; and some other heights as slightly lower than shown on my maps. As, from a biogeographical standpoint, the difference is small, I have kept the long accepted figures on my maps, which were drawn before WERDECKER's article appeared. Taking the altitudes of these summits as, for practical purposes, ' fixed points ', and relating my aneroid readings at intermediate places to them, I am satisfied that the altitudes of the collecting stations are estimated nearly enough for my purpose.

If WERDECKER's conclusions be correct, it may explain why Col. D. R. CRONE

[98] But I have submitted these paragraphs to an expert surveyor of long experience in this part of Africa. His name is among those whose help is acknowledged (p. 80).

who, in a recent survey (1952–53) round Lake Tana, identified several of D'ABBADIE's points of intersection, found that D'ABBADIE's estimates exceeded his own by a mean amount of 25 metres (about 82 feet), a discrepancy which might otherwise be attributed to local causes. The datum used by CRONE was the high-water level of Lake Tana, taken as 1830 metres (6004 feet), a figure based on an assessment of all data available up to 1953. An account of this assessment of recent surveys round the lake appeared in the *Empire Survey Review*, **13**, pp. 220–229, 1956.[99]

In the centre and south of Ethiopia, on the other hand, the heights of some mountains differ considerably, as shown on successive editions of the International Map. The altitude of the base line may not be correctly determined and there is no link between surveys in these parts of Ethiopia and those in the Sudan, where altitudes have now been correctly estimated as far as the Ethiopian Frontier.

Observations by aneroid alone are notoriously unreliable, unless closely controlled by barograph readings at short intervals at some nearby station—a control impossible for me to carry out when travelling long distances alone, in varying weather. Therefore on my last two journeys (1948–49 and 1952–53) I have not tried to fix heights absolutely by aneroid. My instrument, though of excellent quality and well tested, has served mainly to register relative differences, in other words, the amount I had gone up or down in a day's trek.

As I have remarked (1952, p. 109), my aneroid readings in central and southern Ethiopia in several cases indicated that the altitudes of mountains shown on the maps may be too high. Some other travellers have also found this to be the case. On the other hand, some places are marked too low on the maps.

Lake Tana. Though my entomological work on the north shore lasted only a few days, the following facts and opinions about the lake may be useful.

This lake, over 90 miles south-west of Simien, is as dominant a feature in the northern region, as Lake Abaya is in the area of my southern journey (1948–49), but their formation and contours are very different. Lake Tana does not lie in the floor of a rift, but is believed to have originated through the damming up of a shallow depression by volcanic materials.

Lake Tana is about 51 miles from north to south and 39 from east to west, with a surface of nearly 1400 square miles. Lake Abaya, the second largest in Ethiopia, is nearly 44 miles long, but only 7–15 miles broad, and with a surface of about 485 square miles, little more than a third the area of Lake Tana.

Lake Tana lies 6000 feet above the sea. With an area about eight times that of the Italian Lake Garda it is far the largest lake in Ethiopia. Its greatest depth is less than 46 feet. Its basin is small in proportion to the area of the lake itself. Some 60 rivers and streams feed the lake, the longest (about 60 miles) being the Little Abbai, the source of which is regarded as that of the whole Abbai (Blue Nile), which flows out of the lake less than 30 miles south-east of the point where the Little Abbai enters.

Nilsson (1940, pp. 46–49), who investigated certain terraced formations round the whole lake, held them to be ancient beaches indicating a series of lake levels, the highest more than 320 feet above the existing level. He believed that ancient lake sediment, found in the ravines of rivers, belonged to the Gamblian (or Last) Pluvial, and concluded, from all the evidence, that the Tana basin probably did not exist during the Kanjeran (or Great) Pluvial. But Minucci (1938, pp. 31 *seqq.*) supposed its origin to have been earlier, while

[99] Col. Crone writes (1956, p. 224) that D'Abbadie started his triangulation from Massawa, using sea-level as his datum ; but that the triangulation was of the reconnaissance type, and there was ' one discontinuity in carrying forward plan positions from Massawa to Lake Tana '. The figure for the lake was fixed relatively to the figure for Massawa by astronomical observations, the degree of accuracy of which is discussed by Col. Crone.

its level, though formerly higher than at present, was less elevated than Nilsson estimated. Minucci also attributed a rather different nature to the terraced formations; some (he thought) may be deposits due to a former lake level little higher than the present one, while the higher terraces in the river valleys could have originated through harder beds of rock offering greater resistance to erosion.

APPENDIX 2

Amount and situation of collections made in 1952–53

As with my previous expeditions in Ethiopia, all the insects and other zoological specimens have been presented to the British Museum (Natural History), where the *types* of forms new to science will be preserved. The dried plants, as before, have been handed to the Herbarium of the Royal Botanic Gardens, Kew, with a request that the Museum may have a prior claim on duplicates.

The insects from northern Ethiopia and Eritrea amount to about 5088 specimens.[100] These comprise 3315 Coleoptera and much smaller numbers of 11 other Orders. The next largest contingents are about 850 Diptera and 323 Hemiptera. Even in Orders represented by less than ten specimens, the material has proved interesting.

A few other Arthropoda (Arachnida, particularly Opiliones, also Myriopoda and Isopoda), together with a small collection of Mollusca, have been distributed to the Department of Zoology at the Museum.

The approximate total of 5000 insects is comparable with nearly 4400 collected during the journey to the Gughé Highlands in 1948–49 (in this latter figure Coleoptera, 2986 specimens, also predominated; Scott, 1952, pp. 106–107). In both cases the numbers are relatively small, but considering the special interest of the material and the conditions under which the journeys were carried out, I have reason to be satisfied. On both occasions I was the only European member, and in Simien, with a smaller number of retainers, albeit good and willing, I had no one to help in the actual collecting. Pitching and striking camp, travelling from place to place, maintaining supplies, etc., made a full task for my men.

The plant specimens represent some 158 species of flowering plants and five species of ferns. Most of the flowering plants and all the ferns were collected in the high Simien proper, at heights between 9700 and more than 14,000 feet. Some flowering plants were, however, also obtained east of Asmara, between 7900 and 6000 feet, on the Massawa road; also in the valleys of the Mareb and Tacazzé, in the former as low as 4100, and in the latter as low as 2600 feet. Such seeds as I collected were distributed to the Herbarium at Kew, to the John Innes Horticultural Institution (Bayfordbury, Hertford) and to the Royal Horticultural Society's Gardens, Wisley.

APPENDIX 3

Transliteration, and the Meaning of certain Place-names

I have not kept consistently to any one system of transliterating Ethiopian place-names and personal names, either from Amharic, now the official language of the whole country, or from the many other languages and dialects spoken.

[100] The number provisionally entered in the Register (under 1953–335) is 4455, but closely packed specimens preserved in alcohol, not then counted, must be added. The figure in the Register includes more than 50 specimens collected on the beach at Jidda, Arabia, in September 1952, and about five taken on board ship or in the Sudan on the outward and homeward journeys.

Such names are spelt differently by European writers of various nationalities (see Appendix C in my former paper, 1952, pp. 176–178).

In the present paper I have followed the Italian spelling of recent editions of the International Map, etc., in using *gh* before *e* and *i* to denote a hard *g*, as in *Arghine*, *Ghitche*, *Derasghié* and *Beleghès*, and in the personal names *Ghiyorghis* and *Ghidello*. In other cases I have spelt names phonetically, according to English pronunciation ; for instance, using *k* not *ch*, and the initial *W*, not *U* ; thus I have written *Mount Selki* (not *Selchi*), and *Wolkefit Pass*, not *Uolchefit*.

The following notes bear on particular cases :—

(1) SPELLING AND ORIGIN OF THE NAME SIMIEN : having listened carefully to Ethiopians of various social grades, especially those living in the district, it was clear to me that the name is sounded distinctly as a word of three syllables best represented by *Simien*. Recent French, Italian and German writers have written respectively *Semiène*, *Semièn* and *Semien*. All these forms indicate three syllables, but the first vowel, as I heard it, is a short *i*, not *e*, in English spelling.

Some English writers (e.g. Maydon, 1925) have used a two-syllable form, *Simen*, and the latinized adjective *simensis* has been given as a specific name to various animals and plants.

Two-syllable and three-syllable forms have both been used because, in the Amharic alphabet, vowels are joined to consonants, and the Amharic character consisting of *m* and the fifth vowel-sound can denote both *mie*, as I heard the sound in ' Simien ', and *me*, when simply a long *e* is pronounced.

Earlier writers, British and French, used the form *Samen* (Bruce, 1790 ; Salt, 1814 ; Ferret & Galinier, 1847 ; A. D'Abbadie, 1860–73), but the Portuguese author, Manoel de Almeida, writing between 1628 and 1646, spelt the name *Cemen* (*Semen* ; see Beckingham & Huntingford, 1954).

The spelling *Samen* may be due to a confusion. In modern Amharic *samēn* means ' north ', but it is in origin an Ethiopic (Geez) word, first meaning ' south '. Dillmann, in his Ethiopic Lexicon, explains the change of meaning as follows : with the southward extension of the realm, the Simien mountains came to lie in the north ; the word *samēn* may have been confused with the name of the mountains, and may so have come to mean ' north ' (but the word *samēn* and the name of the mountains are differently spelt in Geez, and may have different origins).

(2) RAS DEGIEN : this Italian spelling (or the English form DEJEN) is near the sound of the name, which is not unlike the English word ' dudgeon '. The forms *Dashan*, found in some atlases, and *Dasciàn*, in the *Guida* and some other Italian writings, are quite incorrect. Pichi Sermolli (1940, p. 9) explained that the error of writing *Dasciàn* arose from D'Abbadie's peculiar method of transliteration.

As I have stated above (p. 65), I heard the whole Degien massif called simply ' Degien '. Even if ' Ras Degien ' is reserved for the highest point, I did not hear the names of separate peaks, *Ancua*, *Ualta* (*Walta*) etc. used, though these were recorded by D'Abbadie and by Pichi Sermolli.

(3) RIVERS TERMED ' MAI ' (' WATER ') : by a curious parallel, just as many tributaries and rivers of moderate size in northern England and Scotland are termed ' Waters ' (for instance, Allan Water, Ettrick Water, and many others), so in northern Ethiopia and Eritrea many mountain streams and rivers have the prefix *Mai*. But this term is not applied (so far as I know) to large rivers such as the Tacazzé.

In the northern province of Tigré, the *Tigrinya* language is used, a purer and more direct descendant than Amharic of the ancient *Geez* (Ethiopic). *Mai* means ' water ' in Geez and in Tigrinya, but in the centre and south of Ethiopia the word is not known. The Amharic for ' water ' is *wihā*, and for ' river ',

wanz. In the case of the Mai Shāha, local people in Simien run the two words together and add *wanz*, sounding the name *Meshaha Wanz*. This, literally ' Shaha water river ', is an unconscious repetition, such as may also be found in the names of some ' Waters ' and ' Rivers ' in Britain, when their origin is examined.

Personal Acknowledgments

Having expressed above my indebtedness to scientific bodies, I here gratefully acknowledge help given by many persons in official positions, or privately. Being unable to mention all, I offer apologies to those not named.

Mr. Douglas L. Busk, C.M.G., then beginning his term as British Ambassador, approached the Imperial Ethiopian Government regarding my projected journey, and Col. A. T. Curle, D.S.O., M.B.E., then head of the Consular Section of the Embassy, aided me (not for the first time) about detailed arrangements.

The Emperor's Personal Representative in Asmara, Bitwodded Andarghé Massai, granted me the necessary permit to enter Ethiopia. Dajazmach Asrat Kassa, after taking up office as Governor-General of Beghemder on 6 January 1953, showed me hospitality during my stay in Gondar ; before his arrival I had been received by Colonel Tamrat, Director of the province while the office of Governor-General was vacant ; also by Ato Gamarmé Wondafrash, head of the municipality, and other local officials.

Before visiting Gondar I was indebted to the District-Chief of Simien, Dajazmach Hagos Tessama, and later to his deputy. The Chief of the subdistrict of Ambaras, Kanyazmach Waratta Ayēlu, who accompanied me throughout the trek, deserves special mention, also Ghidello Woldesayek and the other personnel of the caravan.

Mrs. Doris Durell, then Head Mistress of the Ethiopian Government Girls' School at Gondar (and the only English lady resident there) showed me much kindness. Through her I met several Indian and other members of her staff. Dr. von Bassewitz, at the Gondar hospital, treated my temporarily incapacitated chauffeur.

At Dabāt I was entertained by two Swiss missionaries, Herr K. Sutter and Herr W. Sidler, with other members of the Mission to the Falashas (a branch of the Church of England Mission to the Jews).

In Asmara I was substantially helped by Messrs. P. Kercher, J. M. Goodlet, H. W. Massey and others at the Locust Control Centre (Desert Locust Survey) ; also by several British advisers to Departments of the Government of Eritrea.

In the Sudan, homeward-bound, I was first welcomed by Mr. Desmond Hawksworth, then Governor of Kassala Province, by Mrs. Hawksworth and by Sudanese officials. At Khartoum (a very full city in February 1953) hospita lity was kindly given first by Mr. Charles de Bunsen (then Governor of Khartoum Province) and Mrs. de Bunsen, afterwards by Mr. R. C. Wakefield, C.M.G. (then Director of Surveys) and Mrs. Wakefield (Mr. Wakefield has since helped me about geographical questions arising in this paper). Visiting the Stack Laboratories of Medical Research and the Kitchener School of Medicine, I was welcomed by Dr. Robert Kirk, O.B.E. (then Professor of Pathology), Dr. Mansour and other colleagues.

The Rev. Canon A. F. Matthew, still residing at Addis Ababa, though retired from the Anglican Chaplaincy, has answered (in letters) questions, particularly on philological matters.

Since my return I have been aided by many entomologists, other zoologists and botanists, in Britain and abroad ; at the British Museum (Natural History), the Commonweatlth Institute of Entomology, the Herbarium of the Royal Botanic Gardens, Kew, and elsewhere ; for published reports on the material

collected, or information given privately. As their names appear in the text and bibliography, I may be excused for not repeating them here.

Mr. R. E. Moreau, M.A., besides helping me to identify certain birds, made valuable suggestions about parts of this paper.

The finished drawings of the maps were made from my tracings by Miss Mary Potter, at the School of Geography, Oxford ; but to render the route-map of the caravan trek even approximately correct needed assistance from Professor Kenneth Mason, M.C., M.A.

For the two photographs reproduced on Plate 5, I am indebted to Col. H. E. Hebbert, D.S.O., M.C., who also let me draw on his unpublished narrative. Mr. B. G. Head of Henley-on-Thames very carefully enlarged my photographs (more than 300) ; thanks are also due to Mr. G. Atkinson, A.L.S., of the Studio at Kew Gardens. Miss Betty Edwards of Henley-on-Thames has, as before, devoted great care to typing my manuscript.

[*The Editors acknowledge with thanks that a large part of the cost of printing this article has been met from private sources*].

BIBLIOGRAPHY

This consists of two main parts : (1) a list of recently published results of my expeditions in high Ethiopia, and (2) references to works cited in the present paper.

(1) Recently published results of the expeditions

These are mainly general articles and reports based on the two more recent journeys, respectively to the Gughé Highlands in 1948–49 and to high Simien in 1952–53. Some addenda to the long list (given in my previous paper, 1952, 178–181) of results of the original ' Entomological Expedition to Abyssinia, 1926–27 ', are also included.

(a) *Reports cited in the present paper*

The reports hitherto published on material collected in Simien are cited in the text of the present paper, together with some of those on material from the Gughé Highlands. As these are included in the list of References below, it is only necessary here to refer to the authors' names and dates : Basilewsky (1957), Drake (1954), Fagel (1956, 1957), Forcart (1957), Hawkins (1957), Jeannel (1954), Morison (1958), Pagés (1957), Quick (1954), Richards (1954), Roewer (1957) and Scott (1952, 1954, 1955). The full titles of all these will be found below under ' References '.

(b) *Results not cited in the present paper*

Some reports on material collected during the earlier journeys have appeared since my published list (1952). Two items below (under Beier and van Emden respectively) had escaped my notice, though published before that list. Some descriptions of single species, which have appeared in systematic papers not exclusively devoted to results of these journeys, are also included.

Zoological

Basilewsky, P. 1953. Expedition to the Gughé Highlands, 1948–49 : Coleoptera, Carabidae. *J. Linn. Soc.* (*Zool.*), **42** ; 276–292 (this work includes the Carabidae, other than Trechinae and Pterostichinae, for references to which see below under Jeannel and Straneo).

Beier, M. 1944. Über Pseudoscorpioniden aus Ostafrika. *Eos*, **20** ; 173–212 (this work, which I had not seen, includes seven species, representing as many genera, collected during the Entomological Expedition of 1926–27. Two genera and six species were described as new to science. Only one species, recorded from the

Masai Highlands and Mt. Elgon, was previously known. Several of the Ethiopian forms are probably endemic. All the species but one were collected in the temperate coniferous Jem-Jem Forest, west of Addis Ababa. On my later journeys I had few opportunities of searching in such forest, which may explain my having found no more pseudoscorpions).

Carvalho, J. C. M. & Southwood, T. R. E. 1955. Revision of the complex *Cyrtorhinus* Fieber-*Mecomma* Fieber. *Bol. Mus. Para Goeldi*, **11** ; 1–72 (Hemiptera-Heteroptera, Miridae ; includes *Mecomma grandis*, discovered at the edge of Jem-Jem Forest, pp. 55–56 and 65).

Dyte, C. E. 1957. Journey to the Gughé Highlands, 1948–49 : Coleoptera, Psephenidae ; the immature stages of *Eubrianax scotti* Pic. *J. Linn. Soc.* (*Zool.*), **43** ; 111–112. (Pic's description of the adult, placed in Dascillidae, is listed below.)

Fagel, G. 1956 (December). Contribution à la connaissance des Staphylinidae, no. 37 ; Paederinae nouveaux d'Abyssinie. *Bull. Inst. Sci. nat. Belg.*, **32** ; no. 60, 1–12 (includes new species of *Medon*, *Hypomedon* and *Scopaeus* from the Gughé Highlands and elsewhere in Southern Ethiopia). (In the same periodical, 1953, **29** ; no. 20, 26–28, Fagel redescribed *Stilicus clarissimus* Bernhauer, a species widespread in eastern Africa. He there recorded a specimen from the Catar River, Lake Zwai, *c.* 6,000 feet, xi.1926.)

—— 1958. Exploration du Parc National de l'Upemba : Coleoptera, Staphylinidae, Paederini. *Mission G. F. de Witte, fascic.* **51** ; 1–470 (this account of the tribe Paederini, as defined by Jarrige and Fagel, includes many species discovered in other parts of Africa besides the Upemba National Park ; among them forms discovered in high Ethiopia, particularly a new genus and species, *Scotticus abyssinicus*, found in roots of grass-tufts and ferns in the Gughé Highlands, 10,500–11,000 feet, xii.1948, and two new *Paederus*, respectively from Southern Ethiopia, xi.1948, and from high Simien, xii.1952 ; see pp. 31–34 and 181–185 of Fagel's work. The work also includes remarks on many species discovered in Ethiopia during the Expedition of 1926–27, or by other collectors).

Jeannel, R. 1950. Sur quelques Carabiques de la famille des Tréchides receuillis par M. Hugh Scott dans le sud de l'Abyssinie. *Rev. franç. Ent.*, **17** ; 176–183 (part of results of Gughé Highlands journey).

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This beautiful little plant has the largest flowers of any known species of *Uebelinia*. The flowers which I saw were in most cases white, but some plants had flowers of a clear pink colour (not due to fading) ; others again, had white flowers shaded with pink beneath the petals, but these may have been fading white-flowered specimens.

Seeds germinated easily in my cold greenhouse after my return to England. The seedlings formed spreading plants which, however, withered without flowering. The cause is uncertain ; possibly the exceptionally hot, dry summer of 1949 did not favour them, or they may have been over-watered in my efforts to prevent drying up.

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Index of animals and plants mentioned

Names of authors (in full or abbreviated) of species and/or subspecies are shown here, but not usually in the text. Some English and Amharic names are included.

ANIMALS

MAMMALS

Capra walie (Rüppell), Walia Ibex, 15, 37.
Cercopithecus aethiops L., Grivet Monkey, *tota*, 16, 53.
Colobus guereza Oken, Guereza Monkey, 16.
Nilopegamys plumbeus Osgood, 63, 90.
Papio hamadryas (L.), 16.
Theropithecus gelada Rüppell, Gelada Monkey, 15, 59, 67.

BIRDS

Bostrychia carunculata (Rüppell), Wattled Ibis, 16, 57.
Ciconia ciconia (L.), White Stork, 51.
Cinnyris venustus fazloqensis (Heuglin), Variable Yellow-bellied Sunbird, 70.
Coracia pyrrhocorax (L.), Chough, 16, 64.
Corvultur crassirostris (Rüppell), Thick-billed Raven, 57.
Corvus albus (Müller), Pied Crow, 57.
Corvus capensis kordofanensis (Laubmann), Cape Rook, 57.
Geokichla litsipsirupa simensis (Rüppell), Ground-scraper Thrush, 16.
Hypochera ultramarina (Gmelin), Indigo Finch, 51.
Nectarinia johnstoni, subsp. dartmouthi Ogilvie-Grant, 72.
Nectarinia tacazze Stanley, Tacazzé Sunbird, 16, 72
Pentholaea melaena (Rüppell), Rüppell's Chat, 66.
Pinarochroa sordida (Rüppell), Hill Chat, 57.
Scoptelus aterrimus notatus (Salvin), Black Wood-Hoopoe, 72.
Turdus simensis, see under Geokichla.

MOLLUSCA

Phenacolimax riepiana (Jickeli) and other spp., 17, 65.

INSECTS

Acantholepis capensis Mayr, 24.
Acraea encedon necoda Hew., 24.
Acrida bicolor Thunberg, 27.
Afrotarus raffrayi (Fairmaire), 17.
Afrotarus scotti Basilewsky, 17.
Agabus raffrayi Sharp, 22.
Ailopus thalassinus F., 27.
Amara spp., 17.
Anaphaeis aurota F., 24.
Anotylus scotti Fagel, 74.
Antanartia abyssinica Feld., 24.
Apis mellifera L., 49.
Argynnis hyperbius neumanni R. & J., 23.
Astata boops Spin., 24.
Atheta lobeliae Bernhauer, 74.
Atheta paludosa Bernhauer, 74.
Atomaria chillaloensis Scott, 74.
Belonogaster junceus F., 24, 73.
Bembex mediterranea Hal., 24.
Binorbitalia discontinua Richards, 73.
Binorbitalia triseta Richards, 24.
Caecocaelus scotti Straneo, 20.
Calathus aethiopicus Alluaud, 19.
Calathus aethiops Alluaud, 19.
Calathus nitidus Basilewsky, 73.
Calathus ras Basilewsky, 21 73.
Calathus simienensis Basilewsky, 21, 62, 73.
Calephorus compressicornis Latr., 27.
Caminara chlorostictum (Dejean), 22.
Chlaenius dinodoides Chaudoir, 22.
Clivina natalensis Putzeys, 21.
Colias electo L., 23, 33, 49.
Conocephalus conocephalus (L.), 28.
Crabro (Dasyproctus) oedignathus Arnold, 24.
Culex andersoni subsp. abyssinicus Edwards, 26.
Culex pipiens L. and subsp. fatigans Wied., 25, 26.
Cyphononyx flavicornis F., 24.
Dasyleurotettix infaustus (Walker), 27.
Elgonidium leleupi Basilewsky, 21.
Endomia picina Hawkins, 21.
Engramma ilgi Forel, 24.
Epigynopteryx sp., 73.
Gastrimargus rothschildi montana Uvarov, 27.
Haliplus lineatocollis Marsh., 22.
Harpalus spp., 22.
Hemipepsis dedjaz Gribodo, 24.
Homocoryphus nitidulus (Scopoli), 28.
Hypena obsitalis (Hübner), 68.
Liagonum scotti Basilewsky, 19.
Liancalus sp. aff. virens Scopoli, 68.
Liothrips nigripes Moulton, 28.
Lobeliomyia scotti Richards, 24.
Lycaena phlaeas pseudophlaeas Lucas, 23. 33, 49, 59.
Megarthrus abessinus Bernhauer, 74.
Megarthrus simienensis Fagel, 83.
Melanitis libya Dist., 23.
Meligethes spp., 22, 74.
Mimleucania sp., 73.
Mnionomus rhynchopetali Scott, 74.
Mycalesis safitza aethiops R. & J., 23.
Neritius abyssinicus Uvarov, 27.
Odynerus (Rynchium) silaos Saussure, 24.
Oecanthus macer Karsch, 28.
Omotaphus simienensis Basilewsky, 19, 21, 63, 73.
Oxya hyla Serv., 27.
Paracinema tricolor tricolor Thunberg, 27
Pararge felix Warnecke, 23.
Pararge maderakal Guérin, 23.
Paratettix africanus Bolívar, 27.
Peryphus muscicola Basilewsky, 21.
Peryphus scottustulatus (Netolitzky), 73.
Philanthus triangulum F., 24.
Phymateus sp., 27.
Phymateus viridipes Stäl, 27.
Plocamotrechus spp., 18.
Polistes marginalis F., 24, 73.
Pontia daplidice aethiops J. & V., 23, 33, 49.
Psammophila hirsuta Scop., 24.
Pseudomesites gughensis, Marshall, 74.
Pycnodictya galinieri F., 27.
Scotticus abyssinicus Fagel, 82.
Scottojapyx simienensis Pagés, 28.
Simulium aureosimile Pomeroy, 26.
Syrphus sp., 73.
Tabanus kingi Austen, 26, 53.
Tachyura conspica (Schaum), 21.
Taeniorhynchus africanus Theobald, 26.
Taeniorhynchus uniformis Theobald, 26.
Taeniothrips meruensis (Trybom), 28.
Thamnurgus zukwalae Scott, 74.
Thaumatomyia notata (Meigen), 25.
Thaumatomyia secunda (Becker), 25, 41 73.
Theobaldia longiareolata Macq., 26.
Trechus buahitensis Jeannel, 73.
Trechus degienensis Jeannel, 18, 73.
Trechus gugheensis Jeannel, 18.
Trechus pilosipennis Jeannel, 18.
Trechus simienensis Jeannel, 18, 73.
Trechus sjöstedti Alluaud, 18.
Trilophidia angustipennis Kirby, 27.
Uranotaenia balfouri Theobald, 26.
Vanessa cardui (L.), 23, 33, 59.
Xylostiba abyssinica (Tottenham), 74.
Xylostiba scotti Fagel, 73.
Yphthima spp., 23.

ARACHNIDA

Cristina armata Roewer, 74.
Simienatus scotti Roewer, 74.
Stegodyphus sp., 69.

CRUSTACEA (ISOPODA)

Eubelum sp. aff. E. ignavum Budde-Lund, 29.
Gerutha nitida Budde-Lund (?), 29.
Microcercus abyssinicus Barnard (?), 29.
Porcellio sp. aff. P. spatulatus Barnard, 29.

PLANTS

Note.—Fewer species of plants are mentioned in this paper than were named in my article in the botanical journal *Webbia*, vol. **11**, 1955. In the present paper I have usually referred only to plants with which particular insects are associated, or to plants specially characteristic of certain places. On the other hand some additional species, not identified till after the article in *Webbia* had appeared, are mentioned in the present paper and included in this index.

Afrovivella simensis (Hochst.) Berger, 32.
Alchemilla sp., 32.
Aloe eru Berger, 50.
Anemone thomsonii Oliv., 30.
Anogeissus leiocarpus (DC.) G. & P. (A. schimperi Hochst. ex Hutch. & Dalz.), 30, 55.
Arabis alpina L., 59.
Aster richardi Vatke, 59.
Avena sp. (oats), 63.
Barleria induta C. B. Cl., 50.
Barleria ventricosa Nees, 49.
Bartsia longifolia Hochst. ex. Benth., 62.
Becium grandiflorum (Lam.) Pichi-Sermolli, 66.
Blaeria spicata Hochst. ex A. Rich., 61.
Blepharis edulis (Forsk.) Pers., 50.
Boswellia sp. (? papyrifera (Delile) Hochst. ; frankincense-tree), 53.
Brassica nigra Koch (*sanafitch*, mustard), 63.
Campanula rigidifolia Hochst. et Steud. ex A. Rich., 55.
Carduus sp. (stalkless thistle), 59.
Carissa edulis Vahl (*agām*), 66.
Carthamus tinctorius L. (safflower; Amharic *sūf*, name also used for sunflower), 70.
Centaurea varians A. Rich., 59.
Ceratostigma abyssinicum Aschers, 49.
Chrysanthemum frutescens L. (marguerite daisy), 49.
Cicer arietinum L. (*shimbrā*, chick-pea,) 49.
Clematis simensis Fres., 58, 66.
Commelina latifolia Hochst. ex A. Rich., 49.
Cordia abyssinica R. Br. (*wanzé*-tree), 55.
Crambe hispanica L., 68.
Crinum sp., 70.
Discopodium penninervium Hochst., 66.
Dombeya spp., 55.
Echinops sp. (probably E. hoffmanianus Mattfeld), 64.
Ensete edulis Horaninow (*enset*), 52.
Erica arborea L., 32, 56.
Euphorbia candelabrum Trémaux ex Kotschy, 64, 66.
Ferula communis L. (giant fennel), 59.
Ficus sp., 55.
Gymnosporia sp. (*atāt*), 68.
Guizotia abyssinica Cass. (oleifera DC.) (*nūg*, rantil or niger-seed), 70.
Hagenia abyssinica Willd. (*kōssō*-tree, or *quōsō*), 62.
Helichrysum citrispinum Des., 32, 61, 65.
Helichrysum foetidum (L.), 32.
Helichrysum formosissimum Sch. Bip. ex A. Rich., 32, 60.
Helichrysum fruticosum (Forsk.) Vatke, 32, 61.
Helichrysum glumaceum DC., 32.
Helichrysum schimperi (Sch. Bip.) Meissn., 32.
Hibiscus crassinervius Hochst. ex A. Rich., 49.
Hypericum spp., 32, 57, 58, 70.
Juniperus procera Hochst. (*tid*), 33, 65, 67.
Kniphofia sp., 58.
Landtia rueppellii (Sch. Bip.) Vatke, 63.
Lasiosiphon glaucus Fres., 70.
Lobelia giberroa Hemsl. 32, 71.
Lobelia rhynchopetalum (Hochst.) Hemsl., 32, 34, 38, 39, 59, 71–75.
Lotus discolor E. Meyer, 55.
Mentha sp., 66.
Minuartia filifolia (Forsk.) Schweinf., var. schimperi Schweinf., 55.
Moraea schimperi (Hochst.) Pichi-Sermolli, 56.
Myosotis sp., 70.
Myrsine africana L. (*kachamō*), 67.
Myrtus communis L. (*addēss*), 57.
Ocimum sp., 49.
Olea chrysophylla Lam., 31, 66.
Opuntia sp., 49.
Otostegia integrifolia Benth., 50.
Oxytenanthera abyssinica (A. Rich.) Munro, 30, 53.
Pelargonium multibracteatum Hochst. ex A. Rich., 49.
Petamenes latifolius N. E. Br., 56.
Phoenix abyssinica Drude, 31.
Plectranthus defoliatus Hochst. ex Benth., 69.
Podocarpus gracilior Pilger (*zigbā*), 33.
Polystichum magnificum Ballard, 83.
Primula verticillata Forskäl, 32, 55, 67.
Rosa abyssinica R. Br., 58, 67.
Rumex nervosus Vahl, 50, 67.
Ruta graveolens L. (*tena Adam*, rue), 57.
Salix subserrata Willd., 69.
Salvia schimperi Bentham, 63.
Scabiosa sp., 69.
Senecio confertus Sch. Bip. ex A. Rich., 32, 56, 59.
Senecio farinaceus Sch. Bip. ex A. Rich., 32, 65.
Senecio hadiensis Forskäl, 50.
Senecio myriocephalus Sch. Bip. ex A. Rich. 32, 62.
Sorghum sp. or spp. (*māshillā*), 49.
Stereospermum kunthianum Cham., 55.
Swertia schimperi Griseb., 32, 59.
Swertia sp., 67.
Trifolium petitianum A. Rich., 55.
Trifolium rueppellianum Fres., 55.
Triticum monococcum L. (*adja*), 59.
Uebelinea scotti Turrill, 82.
Usnea sp. (lichen), 67,
Vernonia sp., 66.
Viola abyssinica Steud., 23.

List of Maps and Figures in Text

(For the sources from which the maps are adapted, see Appendix 1, p. 75.)

Folding relief map of Ethiopia and Eritrea, opposite p. 6.
Folding route map of caravan-trek in Simien, opposite p. 58.

Fig. 1.—Remnants of a giant volcano, the highest parts of which are the mountains Amba Farit and Kollo, about 25 miles apart (after Nilsson, 1940, fig. 37, p. 55). Amba Farit is shown on my first folding map, over 100 miles south-east of Lake Tana ; p. 9.

Fig. 2.—Traces of former glaciation in the highest part of Simien ; also the ancient giant crater (adapted from Nilsson, 1940, fig. 42, pl. 61 ; ' Great Pluvial ' and ' Last Pluvial ' are respectively Kanjeran and Gamblian in present terminology) ; p. 9.

Fig. 3.—Montane species of *Trechus* from Simien, between 10,800 and 13,000 feet. Left to right : *T. simienensis*, *T. degienensis*, *T. pilosipennis* (all × *c.* 16). These, like the other Simien species, are apterous, but have fully developed eyes ; p. 18.

Fig. 4.—Left, a montane species of *Calathus* (*C. ras*, × 6) from Simien (12,000–14,000 feet) ; wings atrophied but eyes fully developed. Right, *Caecocaelus scotti* (× *c.* 20) from southern Ethiopia (*c.* 8900 feet) ; in this subterranean genus both wings and eyes are atrophied; p. 21.

Fig. 5.—Map showing the whole route, except the caravan journey in Simien (for which see second folding map) ; p. 47.

Fig. 6.—' A view of the mountains of Samen (Simien) and the river Tacazzé ', drawn by Henry Salt in 1810, some 15 miles east of the Tacazzé and 60 miles south-east of the present bridge (from Salt, 1814, opposite p. 353) ; p. 54.

EXPLANATION OF PLATES 1–17

Note.—Twenty-seven photographs are chosen from among more than 300 exposures made with a Rolleiflex camera on Ilford H.P.3 film. Details of exposure were noted whenever possible. In photographing panoramic views and almost all still scenes, a tripod was used, also in many cases a yellow light filter. Seven of these photographs have already been published in my article in *Webbia*, vol. 11, 1955, but the remainder are here reproduced for the first time. One photograph (the lower on Plate 7), taken in the Gughé Highlands in 1948, is also published for the first time.

The two photographs reproduced on Plate 5 were taken by Col. H. E. Hebbert in May 1943 ; my attempt to get a clear view of the lower scene in January 1953 was defeated by thick haze.

Plate 1. Above, mountains north-east of Adua ; 4 November 1952.
Below, consolidated glacial moraine-material in a deep lateral ravine, west side of Mai Shāha valley ; 16 December 1952.

Plate 2. Above, River Tacazzé viewed upstream from the bridge ; 6 November 1952.
Below, River Zarīma looking downstream from the bridge ; the forest contains many *Dombeya* and *Anogeissus* trees ; 7 November 1952.

Plate 3. Above, distant view of the mountains of Tsellemti and Simien from the north (near Addi Arcai) ; bamboo (*Oxytenanthera abyssinica*) in foreground on left ; 6 November 1952.
Below, escarpment and outlying ranges of Simien from the north ; stratoid formation of older volcanic rock (trap series) shown on left ; 24 January 1953.

Plate 4. The northern escarpment of Simien, looking east from the road up to the Wolkefit Pass ; 7 November 1952.

Plate 5. Above, a higher point on the road to the Wolkefit Pass (phot. Col. H. E. Hebbert, 1943) ; in 1952 *Primula verticillata* was flowering where water coursed down the rocks on the left.
Below, looking west from the escarpment edge, north of Gondar (phot. Col. H. E. Hebbert, 1943).

Plate 6. Above, a homestead comprising circular buildings with conical thatched roofs, and rectangular flat-roofed buildings ; in Tigré, north of Adua, 28 January 1953.
Below, group of circular thatched houses forming the residence of the local chief of Ambaras on its south-eastern slope ; valley of affluent of Mai Beleghès in background ; 22 November 1952.

PLATE 7.—Agricultural methods in northern and southern Ethiopia contrasted :—
Above, ploughing in Simien, at Shaha Ghiyorghis ; 19 December 1952.
Below, trenching with a two-pronged mattock on Mt. Tola, Gughé Highlands ; 9 December 1948.

PLATE 8. Above, oxen turning while treading out grain near Enchetcab ; man on right wears a characteristic woven cap, and a skin acros his shoulders ; man on left carries a wooden fork used in winnowing ; 25 December 1952.
Below, basket-making ; a man squats inside the basket, the sides of which he builds up round himself (at Choberé, north of Debbivar) ; 24 January 1953.

PLATE 9. Above, a spinner at Mai Chebri (south of the Tacazzé) winding cotton stretched along the walls of his house ; 24 January 1953 (the cotton is grown at a lower altitude).
Below, the empty-looking uplands of Simien ; boulder-strewn grassland at Mindigabsa ; Mt. Buahit in background ; 15 November 1952.

PLATE 10. Above, the weekly market (Wednesday) at Debārec, district-centre of Simien ; women with plaited sunshades, right of centre ; 12 November 1952.
Below, sheep for sale at the above market.

PLATE 11. *Lobelia rhynchopetalum* in the valley at Arghine ; the author, with servants and police ; scrub of tree-heath (*Erica arborea*) and bush-*Hypericum* in background ; ; 23 November 1952.

PLATE 12. View westward along the main northern precipice, from the Pass of Chennec (at over 12,000 feet) ; 25 November 1952.

PLATE 13. Above, view west from Arcuasié over the promontory of Lori ; the church of *Kidana Mihrat* is concealed in the clump of trees to right of centre ; 25 November 1952.
Below, on slopes above Lori ; a *zabanya* trumpeting through a hollow, dead *gibarra*-stem (*Lobelia rhynchopetalum*) ; 28 November 1952.

PLATE 14. The massif of Degien from the west, at Atgheba Ghiyorghis ; frozen hail lies near summits on left ; light patches at foot of massif are barley-stubbles ; 3 December 1952 (the highest summit, ' Ras Degien ' proper, *c.* 15,000 feet, is about the middle, but may not be distinguishable in this view).

PLATE 15. Above, view from below the Pass of Degien ; frozen hail on ledges ; stunted lobelias and tufted plants in foreground ; 11 December 1952.
Below, a tributary ravine on west side of Mai Shāha ; an irrigation-channel crossing a slope of short turf in foreground ; scrub of *Rumex nervosus* and other flowering bushes in background ; 14 December 1952.

PLATE 16. Above, in Mai Shāha valley, with southern part of Degien massif in background; light patches in foreground and middle distance are grain-stubbles ; 14 December 1952.
Below, Amba Mollé, at mouth of a lateral ravine opening from Mai Shāha valley on west ; wild olive trees (*Olea chrysophylla*) in foreground ; 17 December 1952.

PLATE 17. Left, *Primula verticillata* in the moist, shady head of the ravine ; white flowers of a trailing *Swertia* visible on left ; 17 December 1952.
Right, a tall *tid*-tree (*Juniperus procera*), hung with lichen (*Usnea*), in the grove round the church at Shaha Ghiyorghis ; 19 December 1952.

POSTSCRIPT.

(1) *Rodents mentioned on pp.* 16, 63.—The idea that the small rodents living in warrens resembled Osgood's *Nilopegamys plumbeus* arose from my having particularly noticed the sharpness of the muzzle, the length of the tail, and the fact that the warrens were only seen near water. On the other hand I noted at the time "small dark rodents ", and do not recall that the underparts were as light as is shown in the figure illustrating Osgood's paper. The widely distributed *Arvicanthis abyssinicus*, described by Rüppell as "Mus abyssinicus ", was found by him high in the mountains of Simien, and afterwards in other high places by Blanford, who saw the little animals " by dozens running about " (1870, p. 283). But in skins of this species the tail does not appear long enough. The identity of the animals remains conjectural.

I saw no hares in Simien, nor do I remember seeing any on my earlier journeys in Ethiopia. Yet several species occur there, including at least one (*Lepus tigrensis* Blanford) at high altitudes. Maydon found hares common in the Arussi mountains (1925, p. 180), but does not mention them in the part of his book dealing specifically with Simien.

(2) *The traveller whose drawings were reproduced in "Views in central Abyssinia"* (1868).—As stated above (p. 36), this traveller was not named. But his identity is interesting in connection with the earlier naturalists in Abyssinia, particularly as he was a fellow-captive with W. G. Schimper at Magdala. On the title-page of Sophie Veitch's book it is recorded that the drawings were "taken in pen and ink under circumstances of peculiar difficulty by T. E., a German traveller believed at present to be one of the captives there". Evidently T. E. was T. Essler, one of two German naturalists, the other being K. Schiller. No other person with those initials is included in the complete list of European prisoners given by the British envoy sent to negotiate their release, Hormuzd Rassam, assistant political officer at Aden (see Rassam, 1869, "Narrative of the British Mission to Theodore," vol. 2, p. 29). Rassam described Schiller and Essler as "natural history collectors". Sir Clements Markham, who also gave a list of the captives, stated that these two had gone to Abyssinia with the Duke of Saxe-Coburg, and remained to collect birds. See Markham, 1869, "A history of the Abyssinian Expedition", chap. 2, p. 75, and chap. 10, pp. 340–341, footnote 2.

(3) In the above paper it is taken for granted that "only two species of giant lobelia are found in Ethiopia", namely, *Lobelia rhynchopetalum* and *L. giberroa*. But this may not be correct as regards the whole of Ethiopia, if a lobelia recently collected by Dr. H. F. Mooney, far south of Simien, proves to be (as he believes) distinct from either of those species. Dr. Mooney, British Middle East Forestry Adviser, is at present concentrating his work on Ethiopia.

(4) *Visits of W. G. Schimper to Simien.*—On p. 39, following the work of Dr. G. Cufodontis cited, it is stated that Schimper visited high Simien in 1840, 1850 and 1852. But according to Mr. J. B. Gillett (1957, *Kew Bulletin*, no. 3, p. 460) Schimper's visit in 1840 was not his first. He had already been in high Simien in 1838, at any rate in June, July and August, as shown by the labels attached to his specimens of *Trifolium* and *Dianthus* (I found no representative of the mainly northern and Mediterranean genus *Dianthus*, perhaps through arriving too late in the season).

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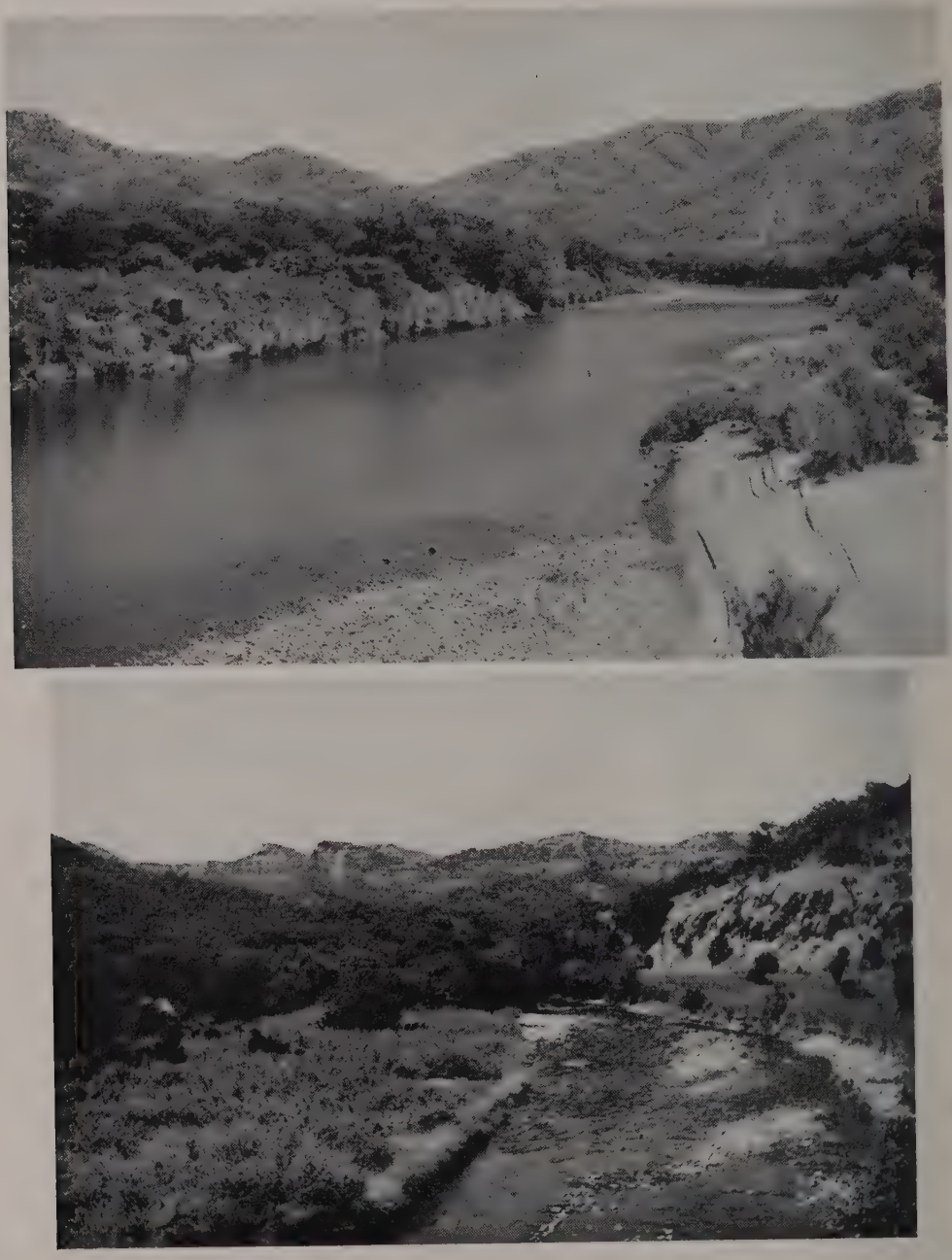

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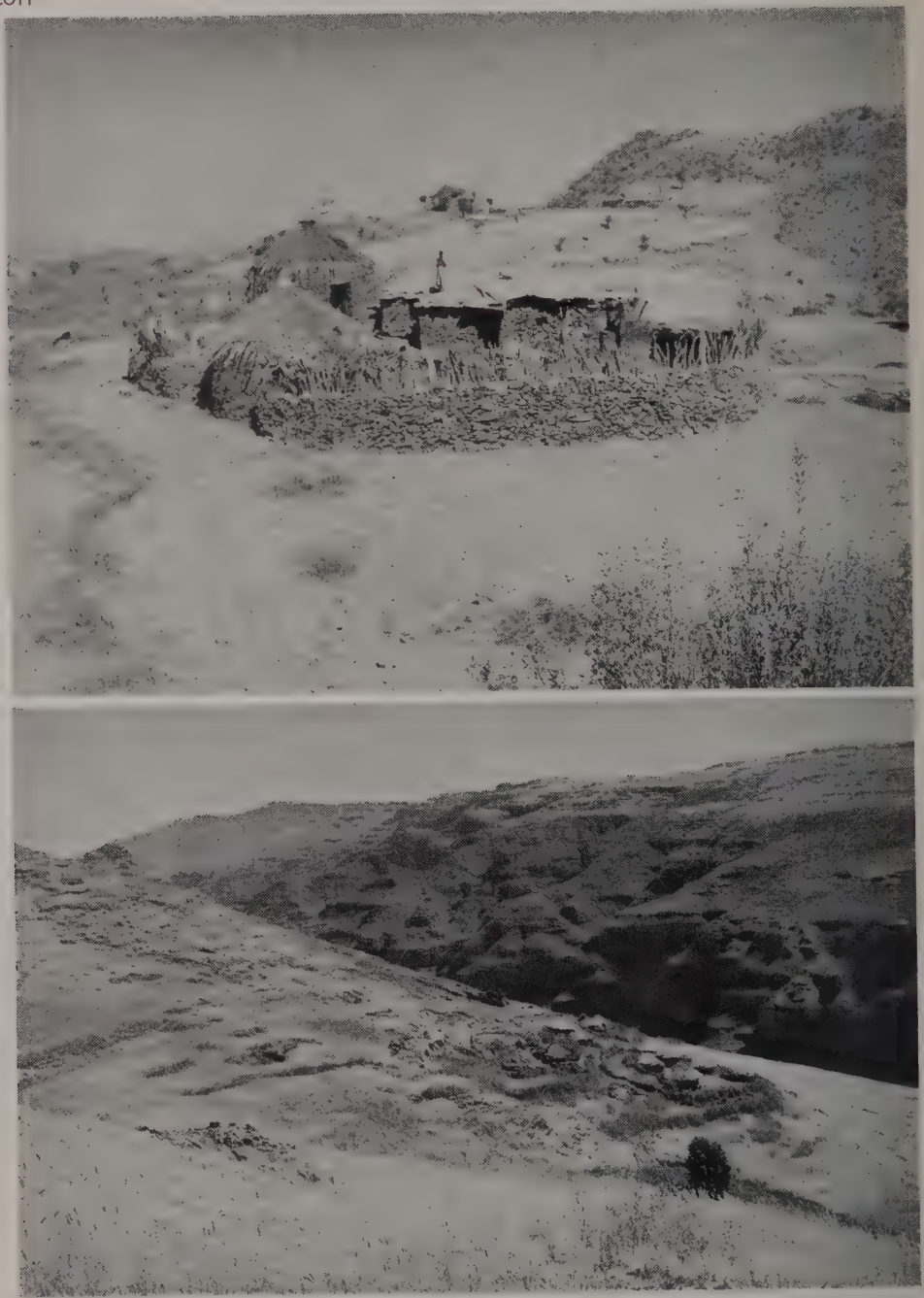

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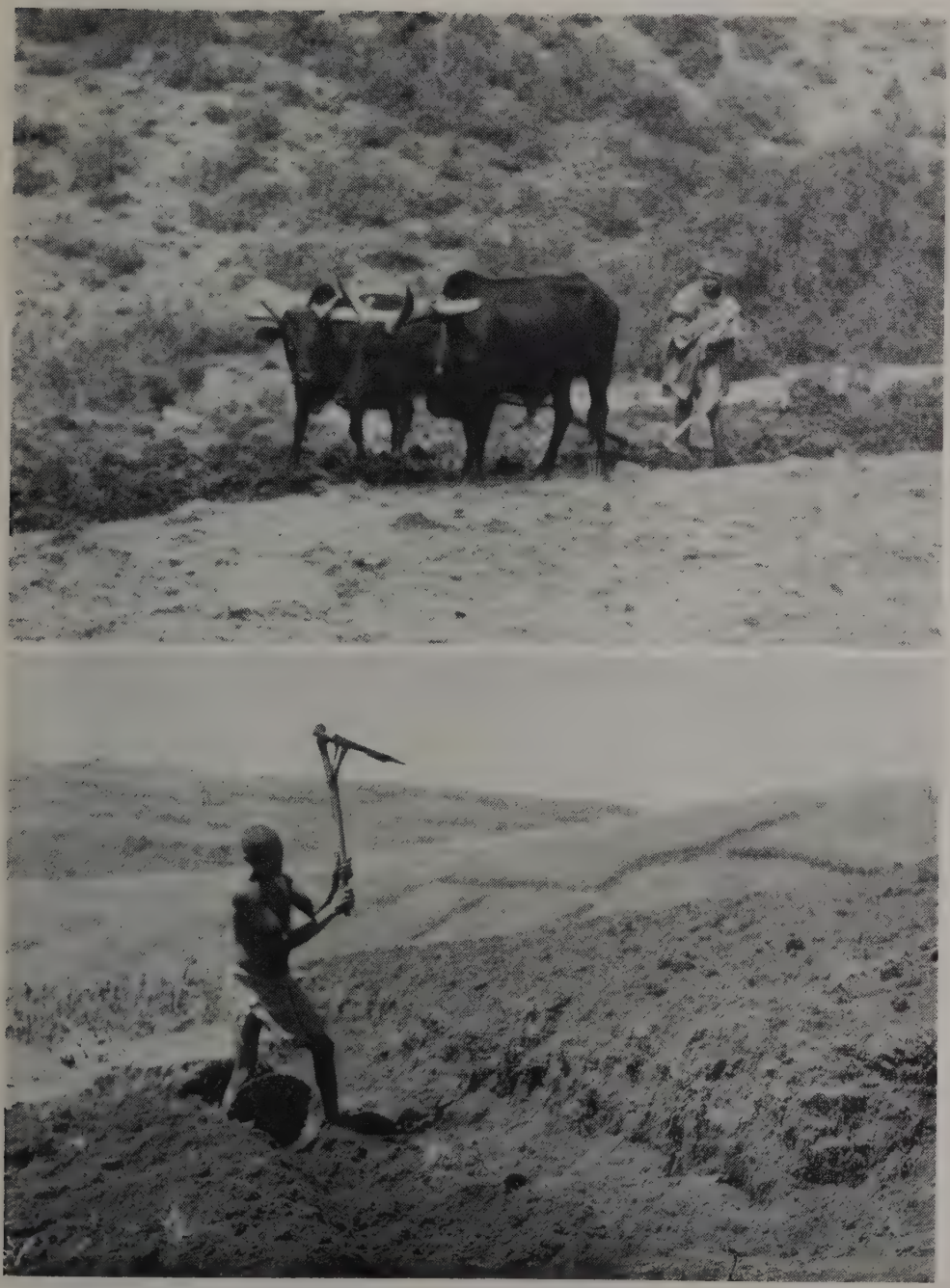

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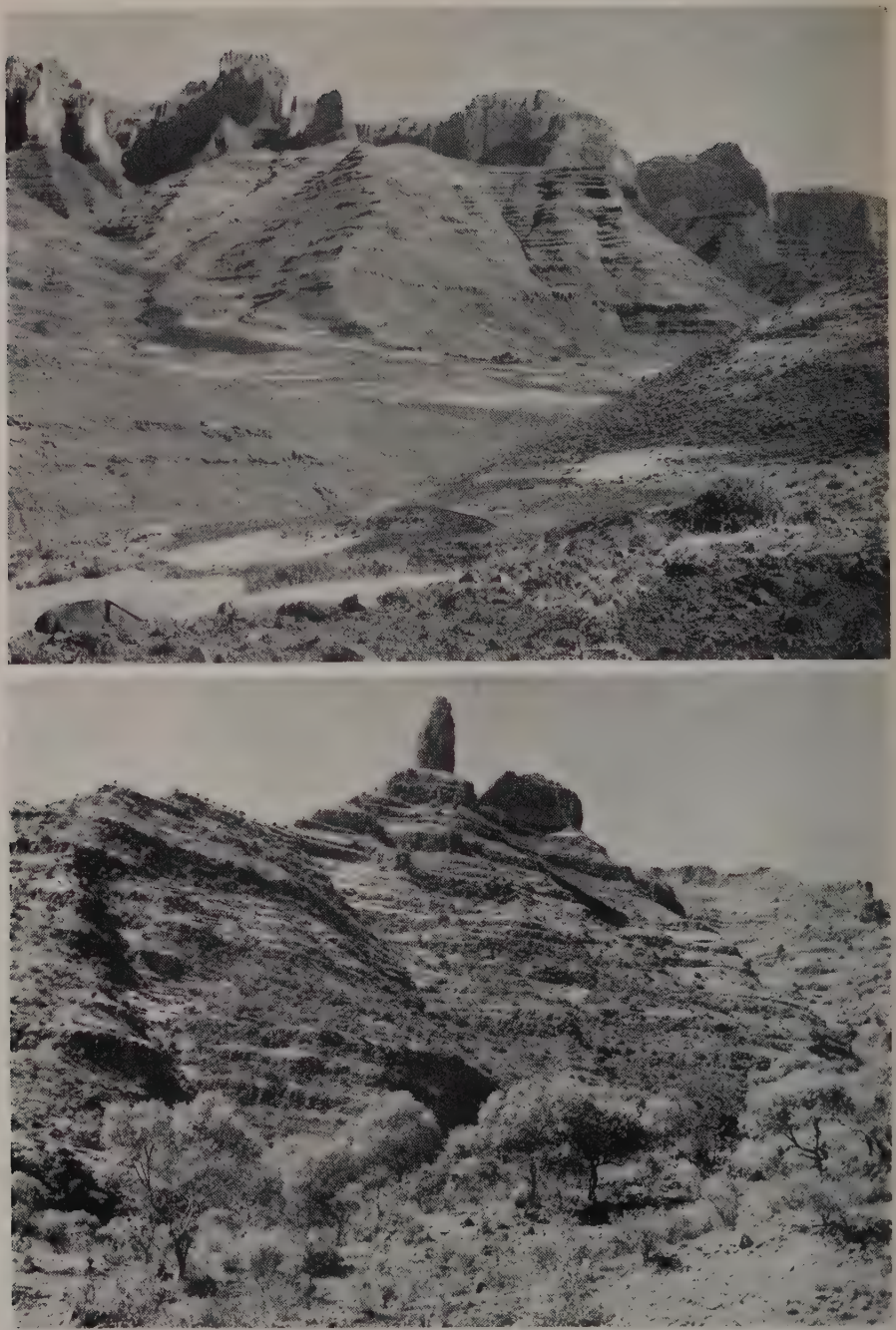

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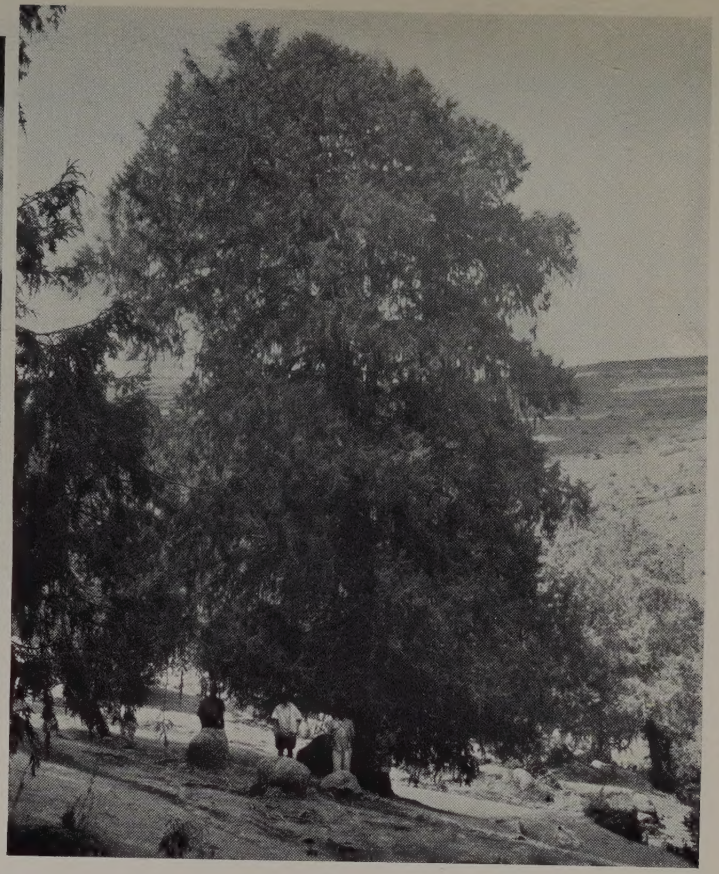

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